ENCLOSURE #1

PRESQUE ISLE STATE PARK

BATHING BEACH CONTAMINATION INVESTIGATION

Year 3

Final Report

Prepared by

ERIE COUNTY DEPARTMENT OF HEALTH

March 1991

The preparation of this report was financed in part through the Pennsylvania Coastal Zone Management Program under provisions of the Coastal Zone Management Act of 1972, administered by the Division of Coastal Zone Management, Bureau of Water Resources Management, Pennsylvania Department of Environmental Resources.

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Preface

During 1988 and 1989 the Erie County Department of Health, with partial funding from Coastal Zone Management of Pennsylvania, conducted studies at Presque Isle State Park to determine causes of high fecal coliform bacteria counts in beach water. The results of those studies are presented in the Presque Isle State Park Bathing Beach Contamination Report, dated June 1989 and the Presque Isle State Park Bathing Beach Contamination Report, Year 2, dated February 1990. In 1990 further work was done to supplement that done in 1988 and 1989. This report is intended to be a summary of the work completed in 1990.

I. Introduction/Background

In the Year 1 and Year 2 bathing beach contamination studies (1,2), it was determined that high levels of fecal coliform bacteria exist in wet shoreline sand and bottom sediment at Presque Isle State Park beaches in the warm summer months and that these bacteria are resuspended in rough water conditions, leading to beach closings. It was also shown under laboratory conditions that fecal coliform could reproduce in moist shoreline materials obtained from Presque Isle. Rainfall increased fecal coliform levels (per 100 ml sample) and flows from streams near Presque Isle. A beach area with a large gull population was shown to have higher fecal coliform levels than a neighboring beach area with less gulls. Areas with decreased circulation (e.g., behind the experimental breakwaters in 1988) were shown to have somewhat higher beach water fecal coliform levels than unprotected areas.

Also, in the Year 1 and Year 2 studies, historical data (starting with 1976) was compared with recent data. Some differences in collection and storage of samples and reporting of results made comparisons difficult. It was determined that differences in regulations, sampling protocols, beach area designations and numbers of samples collected were factors apart from the actual water quality which were responsible for some of the beach closings in recent years. Factors which were noted as possibly influencing increases in actual fecal coliform levels at Presque Isle beaches in the past decade were: increased land development in Erie County (residential and commercial), contributing to non-point runoff reaching Lake Erie; record warm temperatures (both water and air) for several years in the 1980's; replenishment of Presque Isle beaches with upland sand; and reduced circulation behind the experimental breakwaters (Beach 10).

During the 1990 study extensive sampling at Beaches 1, 8, 10 and 11 was continued in order to compare results with those of the Year 1 and Year 2 studies, along with factors such as weather patterns for each year. Work included a sand incubation experiment, a sand raking trial, county-wide sampling of water along the Lake Erie shoreline, bay water sampling and a great deal of work to identify non-point sources. In addition, investigators provided information and guidance to assist Presque Isle State Park with the development of the Protocol for Sampling Beaches.

Work over the past three years has led to the development of a predictive model for immediately closing beaches under particular weather and lake conditions. It is preferable to close beaches immediately when it is predicted that fecal coliform will be high rather than wait 24 hours for sample results, as that initial 24 hours is often the time period with the greatest health risk to bathers. The predictive model was used with success by Presque Isle State Park in 1990.

II. Shoreline Inspections

About 4 miles of shoreline west of Beach 1 (see Figure 1) were inspected on foot for any indications of sewage discharges or other observations worthy of note. This area is serviced by sanitary sewers, though inspections were conducted once in the spring and once in the fall of 1990, with spot checks of some areas conducted during the summer. Samples were collected from stream and storm water discharges and analyzed for fecal coliform levels.

Fecal coliform levels from discharges tested during dry weather conditions were all very low (mostly <20/100 ml; see Appendix D). Wet weather spot checks of streams and storm drain outlets showed elevated fecal coliform levels (see Table 1). No sewage outfalls were discovered. Exposed sanitary sewer lines along the shoreline west of Marshall Run were inspected. These lines once served lake-front cottages that have since been destroyed by storms. No flow from these lines was seen.

Except where cottage owners keep beaches clean, the shoreline west of Presque Isle to the vicinity of Powell Avenue (see Figure 1) generally contains a considerable amount of man-made debris brought by lake waters. Plastic items make up the greatest amount of the debris found. These included plastic bottles and other

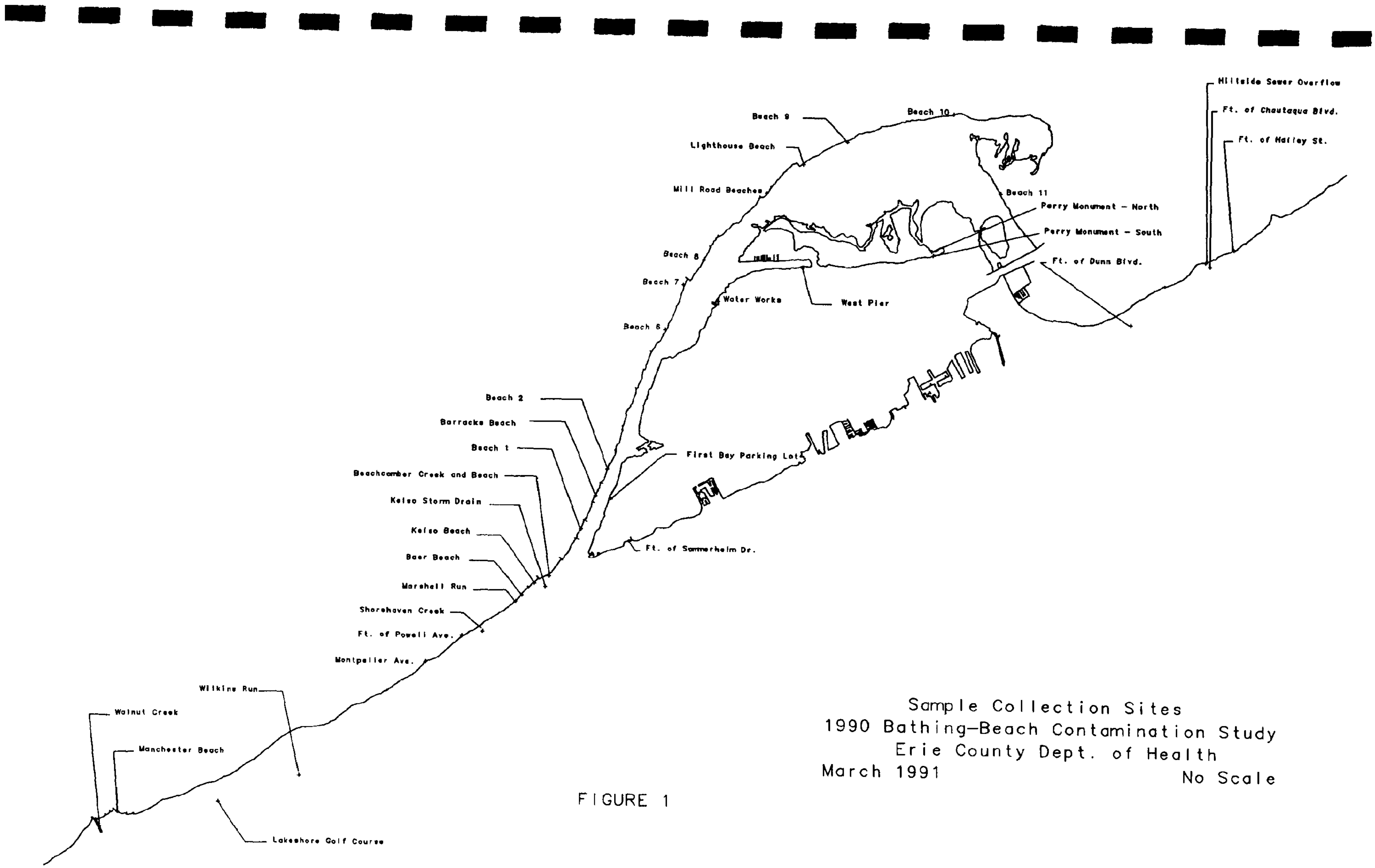
Hillside Sewer Overflow
Ft. of Chautaqua Blvd.
Ft. of Halley St.
Beach 9
Beach 10
Lighthouse Beach
Mill Road Beaches
Beach 11
Perry Monument - North
Perry Monument - South
Ft. of Dunn Blvd.
Beach 8
Beach 7
Water Works
West Pier
Beach 6
Beach 2
Barracks Beach
Beach 1
First Bay Parking Lot
Beachcomber Creek and Beach
Kelso Storm Drain
Kelso Beach
Ft. of Sommerheim Dr.
Baer Beach
Marshall Run
Shorehaven Creek
Ft. of Powell Ave.
Montpelier Ave.
Wilkins Run
Walnut Creek
Manchester Beach
Lakeshore Golf Course
Sample Collection Sites
1990 Bathing-Beach Contamination Study
Erie County Dept. of Health
March 1991
No Scale

FIGURE 1

containers, broken pieces of plastic, balloons, and plastic tampon applicators. The tampon applicators are significant in that they are indicators of raw sewage contamination. Approximately 15 - 20 of these items were observed on each of the two shoreline inspections between Beach 1 and Powell Avenue. Significant numbers of applicators are also found on Presque Isle beaches, especially in the spring. However, as these applicators are virtually indestructable, it is not possible to tell how long they have been in the lake or where they came from.

It is interesting to note that no tampon applicators and very little other manmade debris were seen west of Powell Avenue during either inspection. Driftwood was still seen in this area, as were balloons.

Shoreline inspections were conducted in various areas within about two miles east of Presque Isle. Many areas east of Presque Isle are inaccessible by foot because of steep cliffs with no beach areas. Where inspections were conducted, some serious sanitary problems were seen.

The shoreline area east of Presque Isle which was inspected was primarily within the limits of the City of Erie. This area of the City is served by a combined sewer system with wet weather overflow points which discharge to the lake.

The following are descriptions of specific sites east of Presque Isle.

1. The beach just east from the East Avenue boat launch (also known as the foot of Dunn Boulevard): A combined sewer overflow (with periodic extremely high fecal coliform counts*) enters Lake Erie in the middle of the beach (see Figure 1). Other than the overflow and the odor present from industries in the area, the beach itself is reasonably attractive and many children and some adults from the immediate area swim there. (The area is not a permitted bathing area and was posted with one small "No Swimming" sign.) West of the beach and boat launch is a warm water discharge from quench water that the Erie Coke Corporation plant uses in making foundry grade coke from low sulfur coal. In July a naturally occurring, thick accumulation of dark algae covered the shoreline near the discharge.

2. The foot of Cranch Avenue: A sewage pumping station is located here. Increased flows during wet weather can back up sanitary sewers into homeowners' basements. The City of Erie, to prevent this from happening, will routinely pump the diluted sewage from a sump at Cranch Avenue directly to a stream which enters the lake. The City has also pumped the diluted sewage onto the ground just to the west of the pump station.

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*Often >60,000 fecal coliform/100 ml - see Appendix D

Pumping of sewage at this location occurs only during or after heavy rainfall. Presque Isle beaches routinely experience elevated bacterial levels with these weather conditions, but it is not possible at this time to determine the contribution of this overflow to high counts at Presque Isle.

3. The foot of Chautauqua Boulevard: A stream, a sewage pumping station and a small beach are located here (see Figure 1). Sometimes local residents swim at the beach. Two sewage discharges were noted here.

One discharge consists of a pipe (approximately 1/2 ft. diameter) which discharges sewage to a stream when there are electrical or mechanical problems with the municipal sewage lift station that serves the area, or when a hydraulic overload exists. It is interesting to note that following a rainstorm on September 24, 1990 samples of the discharge and samples upstream and downstream of the discharge all had >60,000 fecal coliform, >60,000 fecal strep and >60,000 *E. coli*/100 ml. City of Erie records indicate a combined sewer overflow point at Chautauqua Boulevard and East Lake Road, about one-half mile south (upstream) of the sampling point. That overflow may have been partially responsible for the high bacterial levels.

The second discharge located at the foot of Chautauqua Boulevard is a pipe approximately two feet in diameter from a hillside just west of the lift station which flows directly to the beach. Much sewage-related debris was seen on the beach (feces, paper and plastic items). During the spring, the discharge flowed constantly regardless of weather. Conditions improved somewhat following maintenance work by the City of Erie Sewer Department. It is believed that this pipe now discharges only during rainstorms.

Approximately 100 tampon applicators appeared on the shoreline of the Gull Point area (between Beach 10 and Beach 11) after a storm in November. These items may have traveled to Presque Isle's shoreline from east-side sewer overflows such as those described above, or from Erie sewage treatment plant effluent after overflow conditions at the plant during a heavy rain.

Samples taken during shoreline inspections are included in Appendix D.

4. Near-shore algae accumulations and associated fecal coliform levels: An additional observation during shoreline inspections was that unusually heavy accumulations of algae appeared along different areas of the Lake Erie shoreline in 1990. Similar deposits of algae were documented in the 1960's but have not been seen in recent years.

The area with the largest accumulations of algae (within the study area) extending from Kelso Beach through the Beachcomber Campground Beach, Presque Isle Condominium Beach and Beaches 1, 1 East and 1 West through Barracks Beach. The algae did not usually occupy this entire area at one time but shifted locations, depending on currents. For instance, on August 2, 1990 a heavy accumulation of algae was present at the Beachcomber Camp beach (and some at the condominium beach) but not at neighboring Kelso Beach or Beach 1 West. Beachcomber Beach had a fecal coliform level of 350/100 ml, and Kelso Beach had a level of 10/100 ml.

Algae accumulations were not unique to locations in the vicinity of Presque Isle. For instance, an inspection of Shade's Beach in Harborcreek Township (about 10 miles east of Presque Isle) on August 6, 1990 revealed heavy algae accumulations. Foamy water in the algae zone had a fecal coliform level of 2,600/100 ml, while clearer lake water had a fecal coliform level of 80/100 ml.

Algae itself is not believed to be a source of fecal coliform. Heavy accumulations of algae, however, seem to be associated with higher fecal coliform levels than nearby clearer waters.

III. Stream, Storm Water and Lake Sampling West of Presque Isle

A. Non-Point Sources - Background

As part of the Year 1 and Year 2 studies (1,2) streams west of Presque Isle were sampled to determine whether they have the potential to affect fecal coliform levels at Presque Isle beaches. It was shown that during or immediately following a rainstorm, fecal coliform levels in streams (per 100 ml sample) were at least 10 times higher than during dry weather levels. Since flows also increase, to perhaps 100 times (or more) of dry weather flow, fecal coliform contributions of these streams during a heavy rainstorm are significant. Bacterial samples of lake water collected upcurrent and downcurrent of streams confirmed the streams' impact on the lake. Beach water at Presque Isle can be affected when wind-driven currents are from the west or east. These findings formed the basis for predictive beach closings, based on certain rainfall and lake current conditions.

Bacterial increases with heavy rainfall are not a new phenomena, nor are they unique to the area of Erie, Pennsylvania. For instance, Koozer State Park (Pennsylvania) has a policy of closing its bathing beach after a heavy rain. During wet weather conditions, silt high in fecal coliform is suspended in Koozer Run, which feeds Koozer Lake where the park's bathing beach is located.

suspected that the decrease in the spring was due to the surface layer of sediment becoming resuspended due to increased stream flow during spring snowmelt and precipitation. In contrast, when stream flow decreased during the summer, bacteria associated with particulates settled to the bottom. A decrease in the bacteriological quality of the Detroit River during the summer was also noted by the Ontario Ministry of the Environment (14). Samples collected during late June and July had higher fecal coliform densities than those collected in May or early June. Kelch and Lee (6) found that drainage from cattle pastures was higher in E. coli in the colder months. They felt that this was due to E. coli's prolonged survival time in low temperatures and accelerated die-off at higher temperatures.

Investigators have found high fecal coliform or E. coli levels in stream sediment (7), river sediment (8), estuary sediment (9-10), canal sediment (11) and lake bottom sediment (1,2,12). These fecal indicator bacteria become suspended during periods of high stream discharge, simultaneously with increases from runoff of terrestrial organisms and settle into the sediments during low and stable flow (7,8). Organisms re-settle downstream, increasing sediment populations there (8). ("Downstream" in the case of ECDH study area could include Beach 1 sediments, for instance.) Bacteria from lake sediments are suspended during periods of high wave activity (1,2).

Matson, et al. (8), states,

> "The importance of aquatic sediments as reservoirs of health hazard indicators is determined by at least two factors: 1) the possibility of extended survival or growth of indicators in sediments (thus altering temporal concepts of wastewater pollution), and 2) the potential for resuspension of the sediment into the water column, thus exposing users to sediment-bound indicators and pathogens."

Struck (9) found that peaks in water counts (in stream water) often correspond to decreases in bacterial counts in sediment and that fluctuations in water and sediment counts are associated with rainfall intensity. Twenty-four hour rainfall greater than 0.10 inch, preceded by several days of dry weather, was sufficient for disturbance and release of sediment-bound fecal coliform. Struck was able to show that 71 percent of the fluctuation in Winter Creek water fecal coliform levels could be explained by corresponding fluctuations in sediment concentrations. He also showed, in growth experiments, that the organically rich stream sediments provided "a suitable environment for fecal coliform reproduction." Struck concludes that the results of his study and others,

". . . indicate that non-point bacterial contamination is not limited to the original source of bacteria, but to the numerous interactions that occur after the fecal coliform enters the stream or estuary. Therefore, future efforts need to focus not only on farms and septic systems, but also on the multitude of land uses that can occur in a rapidly growing watershed."

B. 1990 Stream Monitoring Samples

Five streams and three shoreline areas west of Presque Isle were sampled weekly during the regular bathing season (May 26 - September 3). Samples were collected from the same stream and shoreline sites as in the Year 1 and Year 2 studies (Figure 1), and additional unscheduled samples were collected immediately following several heavy rainstorms. Fecal coliform levels were tested on all sampling excursions. Fecal strep, E. coli and Klebsiella were tested during wet conditions on two occasions. Weekly bacteriological monitoring results are listed in Table 1. The highest bacterial levels in stream water were noted during wet weather conditions in July through September.

Nutrient samples were also collected as part of the 1990 stream monitoring program. Nutrient parameters included total phosphorus, nitrogen compounds (NH_3, NO_2, NO_3) and total organic carbon (TOC). One set of nutrient samples was collected from each of the stream monitoring sites for both dry and wet conditions. Results can be found in Appendix C.

Wet Weather Sampling Excursions

Sampling before and during rain events was conducted on August 12 - 13, August 29 and September 5 - 6 (see Tables 2 - 4). Results showed dramatic increases in fecal coliform levels as soon as stream flows increased.

On August 12 (about 6:00 p.m.) fecal coliform levels in Marshall Run rose from 1,500/100 ml to 14,000/100 ml in a period of 8 minutes at the onset of heavy rain. By the following morning, flow had increased considerably and the fecal coliform level was 36,000/100 ml. Fecal coliform levels and stream flow both started to decrease by afternoon (Table 2).

Lake, stream and storm water samples were collected west of Presque Isle on August 29 following a heavy thunderstorm (Table 3). At least some of the high fecal coliform levels in storm and lake water on August 29 can be attributed to observed sanitary sewer overflows (Section III.D) which occurred at Kelso Beach and at the Shorehaven Drive lift station (Figure 2).

On September 5 high bacterial levels were found in stream water from streams west of Presque Isle immediately after a heavy rainstorm (Table 4). Levels decreased throughout the day but were still elevated, as compared to "dry weather" levels on September 6.

It was also observed that stream fecal coliform levels were higher during summer rain events. Wet weather stream samples in July through September routinely contained in the range of tens of thousands of fecal coliforms per 100 ml sample. By October stream samples collected after a rainstorm had fecal coliform levels in the order of hundreds per 100 ml sample. Spring samples (through early June) were also lower in fecal coliform than summer samples.

Stream and Storm Drain Sampling
TABLE 1

DATE	B.C. BEACH	B.C. STREAM	KELSO STORM DR.	KELSO BEACH	MARSHALL RUN	BAER BEACH	SHOREHAVEN CREEK	WILKINS RUN	WALNUT CREEK	MANCHESTER BEACH	FOOT OF MONTPELIER	FOOT OF POWELL
4/10/90	----	200	620	----	910	----	210	----	----	----	----	----
4/24/90	----	----	----	80	----	----	----	----	----	----	----	----
5/7/90	----	----	----	----	----	----	260	----	----	----	----	----
5/14/90	----	560	670	----	1000	----	230	4000	280	----	----	----
5/17/90	----	----	----	----	----	----	----	----	2700	----	----	----
5/22/90	----	70	330	----	110	----	<10	50	80	----	----	----
5/31/90	240	560	----	10	220	----	80	230	10	<10	----	----
6/7/90	25	320	----	20	460	----	700	30	10	<10	----	----
6/8/90	----	1000	----	----	12000	----	7000	----	1050	----	----	----
6/15/90	<10	1300	----	<10	320	----	450	----	20	<10	----	----
6/20/90	100	800	1400	20	600	----	800	260	50	10	----	----
6/21/90	----	----	----	----	----	----	----	----	80	120	----	----
6/25/90	----	600	1000	420	1500	----	1100	2000	2900	----	----	----
7/5/90	<10	1300	----	500	1200	----	440	----	70	50	----	----
7/9/90	3700	9000	3700	3600	24000	----	2900	9000	1900	240	----	----
7/12/90	----	10000	----	----	60000	----	5400	----	----	----	----	----
7/20/90	1500	>6000	----	----	>6000	----	300	----	----	----	----	----
7/23/90	210	1800	----	100	1200	----	----	----	----	----	----	----
7/24/90	20	1100	----	20	300	----	240	----	110	20	----	----
7/26/90	<10	690	----	<10	200	----	200	150	110	<10	----	----
7/31/90	----	----	----	----	5200	----	----	----	----	----	----	----
8/2/90	350	110	----	10	310	----	580	70	20	<10	----	----
8/7/90	3200	50000	----	140	13000	----	8000	----	----	----	----	----
8/8/90	----	28000	----	----	9000	----	2700	----	----	----	----	----
8/9/90	30	2000	1300	<20	240	----	2000	----	----	----	<20	----
8/12/90	----	----	----	----	1500	----	----	----	----	----	----	----
8/13/90	----	----	----	----	36600	----	----	----	----	----	----	----
8/15/90	40	690	----	110	3000	----	550	----	----	----	----	----
8/22/90	1000	400	----	<10	900	----	1300	----	----	----	----	----
8/26/90	3000	>60000	>60000	1000	34000	4000	5000	----	----	----	40	28000
9/4/90	----	----	----	----	310	10	----	----	----	----	----	----
9/5/90	----	12000	8000	1000	>60000	7000	10000	----	30000	----	7000	23000
	----	6000	2000	----	19000	----	3000	----	----	----	----	3000
	----	8000	----	----	26000	----	10000	----	----	----	----	1000
	----	----	----	----	10000	----	----	----	----	----	----	----
9/6/90	----	4000	----	110	2000	120	1000	170	2000	580	10	2000
9/12/90	----	----	2000	----	3000	----	----	----	----	----	----	----
9/17/90	----	----	390	----	3000	----	1000	----	----	----	----	----
9/18/90	----	----	----	----	----	----	----	----	----	----	----	1800
9/20/90	----	----	1000	----	----	----	----	----	----	----	----	----
9/27/90	----	520	510	----	120	----	500	----	----	----	----	520
9/26/90	----	----	----	----	----	----	----	60	50	----	<10	----

TABLE 2

Marshall Run Sampling
August 12-13, 1990

August 12, 1990

5:55 PM Samples were collected by Bob Wellington, ECDH. There was a light rain earlier in the afternoon. A heavy rain event started about 15 minutes prior to sampling (about 5:40 PM EDST). Water at Marshall Run was clear, 1.5 - 2 ft. wide and 2 in. deep. Estimated stream volume was 200 gal. per minute at the time of sampling. Stream was clear. Water temperature was 64°F. Lake Erie was calm.

Sample Collected: 1,500 fecal coliform/100 ml

6:03 PM Water at Marshall Run was very muddy, 4 ft. wide and 3 in. deep. Estimated volume was 300 gal. per minute.

Sample collected: 14,000 fecal coliform/100 ml

6:11 PM Water at Marshall Run was very muddy, 4 - 6 ft. wide and 3 in. deep. Estimated volume was 400 gal. per minute. Stream temperature was 66°F.

Sample collected: 5,800 fecal coliform/100 ml

6:12 PM Water sample collected 50 ft. west of Marshall Run on beach (lake water). Lake Erie was clear at this point. Water temperature was 75°F. Current was going from west to east. A muddy plume was developing along the shoreline east from the creek.

Sample collected: 120 fecal coliform/100 ml

Rained all night (very heavy at times)

August 13, 1990

8:50 AM Stream sample was collected by Bob Wellington, ECDH. Mud plume extended perhaps 1/2 mile out into Lake Erie and was approaching Beach #1. However, the wind reversed direction (from the west) the night before to a NNE direction. Water at Marshall Run was very muddy, 12 ft. wide and 2 - 3 ft. deep. Estimated volume was 5,000 gal. per minute. Stream temperature was 67°F.

Sample collected: 36,000 fecal coliform/100 ml

TABLE 2 (cont.)

Marshall Run Sampling
August 12-13, 1990

8:58 AM	Water sample was collected 50 ft. west of Marshall Run on beach (lake water). Same lake area as noted above. Waves on Lake Erie were 2 - 3 ft. (estimated NNE direction). Water at this site was cloudy but not muddy like the stream.
	Sample collected: 2,500 fecal coliform/100 ml
1:25 PM	Stream water at Marshall Run was clearing up. Stream still very high.
	Sample collected: 13,000 fecal coliform/100 ml
1:32 PM	Water sample was collected 50 ft. west of Marshall Run on beach (lake water). Same lake site as above; waves now less than 1 ft. Lake Erie was now muddy to the west (possibly due to reverse flow and/or influence from Walnut Creek) but clearer to the east near near Beach #1.
	Sample collected: 4,500 fecal coliform/100 ml
1:35 PM	Sample of rain water was collected from a puddle nearby on a private roadway. No houses are nearby; all houses in vicinity on bluff are sewered.
	Sample collected: 60,000 fecal coliform/100 ml

Beaches 10 and 11 were later closed (August 14-15, 1990). Possible causes are the Mill Creek tube combined sewer overflows and Chautauqua lift station overflow. Wind from the NNE may aspirate bay water out through the channel, potentially affecting these beaches.

TABLE 3

August 29, 1990

	Fecal Coliforms /100 ml	Fecal Strep /100 ml	E. Coli /100 ml	Klebsiella /100 ml
Flooded Road - Kelso Beach	>60,000	>60,000	>60,000	9,000
Flooded Road - Kelso Beach	53,000	>60,000	54,000	8,000
Kelso Beach - Lake Water	1,000	6,000	1,080	180
Baer Beach - Lake Water	4,000	18,000	2,000	2,000
Marshall Run	34,000	58,000	24,000	5,000
Flooded Road - Baer Beach	35,000	51,000	28,000	1,000
Millcreek Storm Drain at Bottom of Kelso Beach Access Road	>60,000	>60,000	>60,000	11,000
Shorehaven Creek - Above Lift Station	10,000	5,000	6,000	2,000
Shorehaven Creek - Below Lift Station (Note: this lift station was overflowing earlier in the morning)	5,000	3,000	5,000	1,000
Beachcomber Creek (most of flow is from west branch)	>60,000	>60,000	56,000	7,000
Beachcomber Creek, West Branch (mostly storm water from Kelso)	>60,000	>60,000	>60,000	18,000
Drainage from Waldameer into Beachcomber Creek, West Branch	60	360	60	20
Beachcomber Creek, South Branch	1,000	3,000	1,040	120
Beachcomber - Ditch by Arcade	>60,000	42,000	61,000	8,000
Beachcomber Beach - Lake	3,000	4,000	880	200

TABLE 3 (cont.)

August 29, 1990

	Fecal Coliforms /100 ml	Fecal Strep /100 ml	E. Coli /100 ml	Kleb-siella /100 ml
Puddle - Beachcomber Parking Lot	>60,000	33,000	>60,000	20,000
Foot of Montpelier Avenue - Storm Drain	40	20	20	<20
Foot of Montpelier Avenue - Water Running Down Road	3,000	2,000	1,320	<20
Foot of Powell Avenue Storm Drain	28,000	29,000	21,000	3,000
Beach 1 West	1,700			
Beach 1 West	1,500			
Beach 1	700			
Beach 1 East	1,200			
Barracks Beach	500			
Barracks Beach	600			

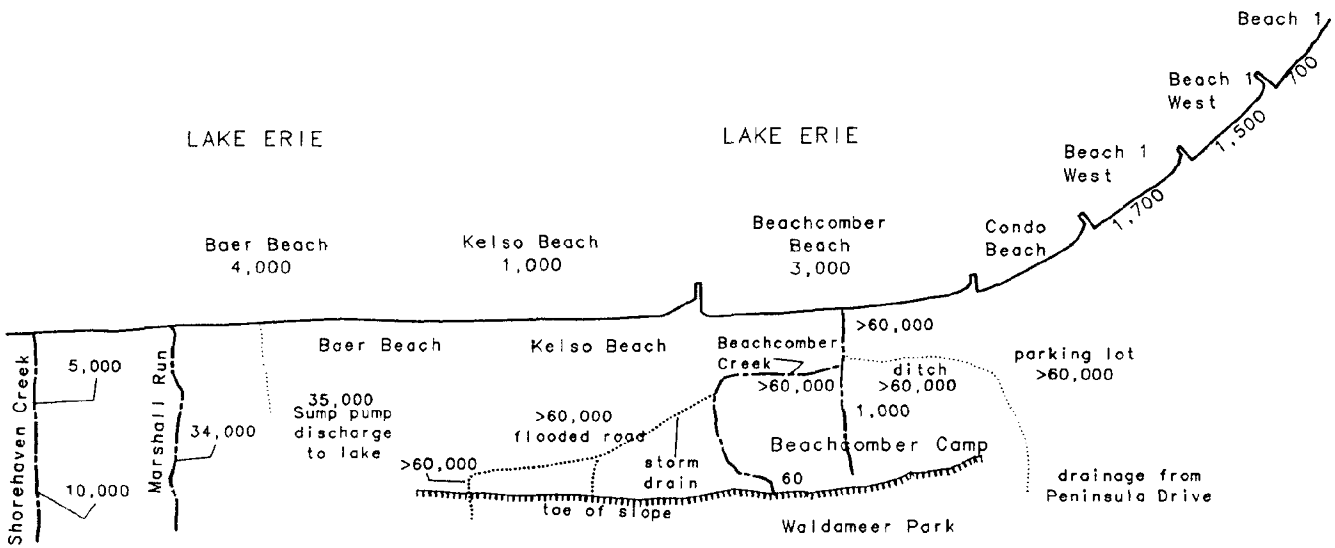

FIGURE 2

Numbers = Fecal coliform colonies per 100 ml

FECAL COLIFORM CONCENTRATIONS
August 29, 1990
Erie County Dept. of Health
March 1991 No Scale

TABLE 4

September 5 - 6, 1990

Fecal Coliform/100 ml

	SEPTEMBER 5				SEPTEMBER 6
	10:00 AM - 12:00 PM	1:00 PM - 2:30 PM	2:45 PM - 3:30 PM	3:45 PM	12:40 PM - 2:35 PM
Beach 1W Ext.	1,000				
Beachcomber Stream	12,000 (Fec.Strep 41,000) (E.Coli 13,000)	6,000	8,000		4,000 (E.Coli 3,000)
Beachcomber - West Branch	11,000 (Fec.Strep 20,000) (E.Coli 6,000)				3,000 (E.Coli 3,000)
Beachcomber - South Branch	>60,000 (Fec Strep >60,000) (E.Coli 58,000)				6,000 (E.Coli 4,000)
Kelso Beach - Lake Water	1,000				110
Millcreek Storm Drain on Kelso Property	8,000 (Fec.Strep >60,000) (E.Coli 7,000)	2,000			1,000 (E.Coli 840)
Marshall Run	>60,000 (Fec.Strep 34,000) (E.Coli 54,000)	19,000	26,000	10,000	2,000 (E.Coli 900)
Baer Beach - East of Marshall Run	7,000				120
Baer Beach - West of Marshall Run	6,000				

TABLE 4

September 5 - 6, 1990

Fecal Coliform/100 ml

	SEPTEMBER 5				SEPTEMBER 6
	10:00 AM - 12:00 PM	1:00 PM - 2:30 PM	2:45 PM - 3:30 PM	3:45 PM	12:40 PM - 2:35 PM
Shorehaven - Upstream of Lift Station	8,000				
Shorehaven - Downstream of Lift Station	10,000 (Fec.Strep 18,000) (E.Coli 9,000)	3,000	10,000		1,000 (E.Coli 810)
Foot of Montpelier Ave.	7,000 (Fec.Strep 800) (E.Coli 4,400)				10 (E.Coli <10)
Foot of Powell Avenue	23,000 (Fec.Strep >60,000) (E.Coli 18,000)	3,000	1,000		2,000 (E.Coli 2,000)
Lake Erie at Foot of Powell Avenue	490				
Walnut Creek		30,000 (Fec.Strep >60,000) (E.Coli 24,000)			2,000 (E.Coli 2,000)

C. 1990 Non-Point Source Sampling

Because of high bacterial levels found in streams during wet weather, efforts were made by the Health Department to determine fecal coliform levels in storm drainage entering streams west of Presque Isle. Storm sewer maps were obtained from Millcreek Township, and samples of storm water were collected at various points (upstream and downstream) in the drainage areas of the Beachcomber Campground creek, Marshall Run, Shorehaven Creek, the Powell Avenue storm drain, a storm drain at the foot of Montpelier Avenue, Wilkins Run, an unnamed stream which runs through the Lake Shore Country Club and various other unnamed storm drains. Miscellaneous samples of storm water were collected east and south of Presque Isle, as well as to the west. Results of this storm water sampling program are in Appendix D.

It was observed that samples taken from puddles with suspended sediments generally had higher fecal coliform levels than samples from clear-looking puddles. Analysis of sediment samples from several storm drains confirmed that storm drain sediment can contain very high fecal coliform levels. Sediment fecal coliform results are included in Appendix D, and nutrient results in Appendix C.

Additional work on non-point sources of fecal indicator bacteria west of Presque Isle is planned for 1991.

D. Sanitary Sewer Overflows in the Vicinity of Presque Isle

Known sewer overflows in Millcreek and Fairview west of Presque Isle were not frequent in 1990, as compared to the frequent combined sewer overflows into the Presque Isle Bay and just east of Presque Isle. However, when these overflows do occur, they may contribute to beach closings and result in increased health risks for the public. (Fecal coliform from human sewage is more likely to indicate health risks to humans than is fecal coliform from animal sources, because not all animal pathogens affect humans.)

It should be noted that all of the area in the immediate vicinity of Presque Isle is sewered. However, much of the Walnut Creek drainage area is rural and on septic systems. Drainage from that area could affect Presque Isle, depending on currents.

Overflows at two sites west of Presque Isle were documented on August 29, 1990 following a heavy rainstorm. An overflow at a Millcreek Township sewage pump station on Shorehaven Drive was seen at 11:30 a.m. In addition, raw sewage escaped from manhole covers on Kelso Beach. The Millcreek Township Sewer Authority attributed the overflow at Kelso Beach to increased sewage flows (from the storm) not being able to negotiate a 90^{o} bend in the sewer pipe. The 90^{o} bend may be straightened by Millcreek Township if there is a recurrence of the problem. It is not known if there were additional overflows elsewhere west of Presque Isle, but overflows east of Presque Isle almost certainly occurred on August 29. Presque Isle State Park closed Beach 1 West, Beach 1, Barracks Beach and Beach 11 as a precautionary measure (also see Section III.B and Table 3).

The Health Department received two reports of sewage escaping to the ground from a lift station on Route 5 at Wilkins Run during 1990. By the time the complaints were received, sewage was no longer flowing to the ground; therefore, the incidents were not confirmed.

On June 20 an anonymous source reported that a power outage to a Fairview Township sewage lift station located on Manchester Road had resulted in a malfunction on Sunday, June 17. At about the same time, Pennsylvania Fish Commission personnel at the Walnut Creek access area noticed a dark, dirty, soot-like accumulation floating in their north basin. A sample of this substance, collected June 20, had a fecal coliform level of 3,000/100 ml. (It should be noted that the first Presque Isle beach closings of 1990 occurred as a result of samples collected June 18 at Beach 1 West, Beach 1, Beach 1 East, Barracks Beach and Beach 2, following a rainstorm and currents from the west). According to the Millcreek Township Sewer Authority, the Shorehaven pump station is scheduled for improvements which will be completed before the 1991 bathing season. The following work is planned: purchase and installation of an electric generator (an on-site generator will eliminate delays waiting for a portable generator during a power outage); the replacement of the existing pumps; and miscellaneous other work, including installation of a high water alarm and modification or replacement of the existing bar screen. These improvements should hopefully eliminate sewage overflows at this location, thereby improving lake water quality west of Presque Isle.

Although occasional sewer overflows occur west of Presque Isle during very heavy rainfall events, it seems that the greatest amount of fecal coliform contribution from this region is from non-point source runoff. Non-point runoff and the related issue of storm water management are increasingly evident as important issues to be dealt with as urban expansion occurs in Erie County.

IV. Bathing Beach Sampling

A. Routine Monitoring Samples

During the 1990 bathing season, the same four areas studied in 1988 and 1989 (Beaches 1, 8, 10 and 11) were utilized for intensive data collection. In 1990 samples were collected four times per week at each of these four areas during the bathing season. The Sunday and Monday collections were part of Presque Isle State Park's sampling program.* Additional samples were collected by an ECDH employee using the same sampling protocol on Wednesdays and Thursdays. Three separate samples were collected from each beach on every occasion - one near each side and one in the center. The arithmetic average of the three was considered the "sample" for that day.

A tabulation of all Presque Isle State Park bathing beach samples is included in Appendix B. Locations of beach sampling sites are included in Appendix A.

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*Appendix A is Presque Isle State Park's Protocol for Sampling. The Protocol was written in the spring of 1990 by PISP, Erie County Department of Health and Pennsylvania DER Community Environmental Control personnel and was based partially on information gathered during Year 1 and Year 2 of this investigation. It provides detailed information on how samples were collected and how sample results were used to close or open beaches.

Table 5 summarizes Presque Isle bathing beach samples taken since 1976. The table reports the percentage of samples from each sampling site each year which equals or exceeds the geometric mean limit of 200 fecal coliform/100 ml. It can be noted that more areas were sampled on a regular basis and more samples collected in 1990 than ever before. It is believed that Presque Isle State Park has one of the most intensive beach sampling programs anywhere.

The number of times and dates each beach was closed, as well as percentage of closures for each beach was tabulated by Presque Isle State Park (Table 12).

B. Hourly Sampling

On Tuesday, June 26, 1990 fecal coliform samples were collected at specific locations on an hourly basis. The purpose of hourly sampling was to monitor changes which might occur during the course of a day under certain weather conditions. Extensive hourly sampling was conducted during the Year 1 and Year 2 studies (1,2).

Four sections of Beach 1 and Barracks Beach were sampled hourly from 8:00 a.m. through 8:00 p.m. for fecal coliform. Samples were collected by Department staff and transported to the Erie DER Laboratory for analysis. Sample results are reported in Table 6.

TABLE 5

Percent of Samples With $\geq$200 Fecal Coliforms/100 ml

Year	Beach 1	Barracks Beach	Beach 2	Beach 6	Beach 7	Beach 8	Mill Road	Light House	Beach 9	Beach 10	Beach 11	All Beaches	Water Temp*(°F)	Samples Collected
1976	7.6			8.0	4.0	4.4			0.0	0.0	7.9	4.7	68.4	253
1977	11.7			7.7	0.0	3.2			0.0	2.0	2.4	4.3	68.2	306
1978	2.0			5.6	0.0	0.0			0.0	8.8	2.1	4.0	68.6	176
1979	11.1			9.5	11.1	11.8			6.3	8.8	20.5	14.2	66.5	311
1980	16.1			10.0	11.1	5.3			0.0	0.0	15.8	11.3	70.3	236
1981	27.6			17.6	0.0	13.3			6.7	26.7	7.9	14.6	68.2	161
1982	14.3			0.0	14.3	0.0			21.4	7.7	7.8	10.2	66.0	137
1983	10.7			0.0	8.3	0.0			16.7	21.4	16.7	12.0	67.2	150
1984	33.3			12.5	13.3	15.4			0.0	25.0	10.3	15.5	67.6	167
1985	5.9			0.0	0.0	6.3			0.0	4.8	8.1	5.3	65.1	206
1986	13.0			9.4	8.7	5.3			25.0	16.7	1.3	9.5	67.2	272
1987	23.5			17.6	22.2	36.8			25.0	17.1	11.1	18.1	69.7	192
1988	22.1			30.0	22.7	19.5			30.4	33.4	13.5	21.7	69.7	878
1989	27.3			7.1	14.3	14.8			11.1	16.9	18.7	19.3	70.1	740
1990	35.5	34.9	27.3	29.4	26.5	20.0	30.0	20.7	23.3	16.1	13.1	25.2	65.9	1,401

*From Presque Isle State Park records; Memorial Day weekend through Labor Day

June 26 was a sunny, calm day. Wave heights were from <1/2 ft. to 1 ft. Average wind speed for the day was 11.1 mph from the southwest. Bather load was zero to low for most of the day, with medium bather load at 2:00 - 3:00 p.m. There had been no precipitation for several days and, therefore, probably little direct impact from streams to the west on this day. There were no breakwaters at Beach 1 or Beach 1 West. There was one breakwater at Beach 1 East. Another breakwater was located between Beach 1 East and Barracks Beach and two were located at Barracks Beach at the time of this sampling event.

It was also noted that there was an accumulation of algae along the shoreline at Beach 1 East and Barracks Beach on this day. The accumulation was heaviest at Barracks Beach. As noted in Section II, fecal coliform levels in the algae zone itself are likely to be higher than levels in surrounding water. None of the samples collected on June 26 were collected in the algae zone. Wave action at Barracks Beach was very low (calm to 1/2 ft.) on this day. The higher counts coincided with (or followed) a period of 1/2 ft. waves, which occurred 10:00 a.m. - 12:00 p.m. It is possible that this wave action, though very mild, may have released some fecal coliform from the algae zone near the shoreline.

As can be seen in Table 5, fecal coliform levels were quite low throughout most of the day at the four Beach 1 area sampling sites. Barracks Beach had significantly higher peak, mean and geometric mean counts than the other four areas.

Fecal coliform levels on this day are assumed to depict typical conditions for this area on a day with no precipitation and little wave action.

TABLE 6

June 26, 1990

Fecal Coliform/100 ml

Time	Water Temp.	Beach 1 West (West End)	Beach 1 West (East End)	Beach 1	Beach 1 East	Barracks
8 AM	64°F	60	80	70	30	10
9	65°F	10	30	20	10	<10
10	66°F	150	20	50	40	90
11	66°F	<10	30	30	30	100
12	68°F	40	<10	40	30	270
1 PM	70°F	10	<10	30	140	120
2	70°F	<10	<10	20	---	---
3	70°F	10	10	30	40	20
4	70°F	<10	10	10	10	30
5	70°F	10	<10	<10	20	<10
6	70°F	<10	<10	<10	10	50
7	70°F	<10	10	<10	10	150
8	70°F	<10	<10	100	20	<10
Arithmetic Mean		27.0	19.2	33.1	32.5	72.5
Geometric Mean		15.7	14.7	25.0	23.2	39.2

V. Bay Water Sampling

Bay water samples were collected once per week throughout the 1990 bathing season (as well as some pre-season and post-season samples) from five selected locations (see Figure 3). These sites were intended to be control areas for the sampling program. The samples were tested for fecal coliform levels.

One site, at bay parking lot #1, had variable water quality. That area of the bay is likely influenced by drainage from Scott Run, depending on whether currents from that direction were present. Scott Run was tested and it was found that a branch of the stream which crosses West Sixth Street just east of Sixth Street and Peninsula Drive was possibly the source of much of the fecal coliform. Because fecal coliform levels were higher than could normally be attributed to storm drainage and because dry weather fecal coliform levels were also elevated, it is possible that at least part of the problem may be due to illegal sanitary sewer hookups to storm drains south of West Sixth Street. However, there was no visual evidence of sewage noted (feces, paper, etc.). This information was referred to enforcement personnel from the ECDH Environmental Health Division for further investigation.

The other four bay sites tested had consistently low fecal coliform levels (see Table 7). If these four areas had been bathing beaches, none would have been

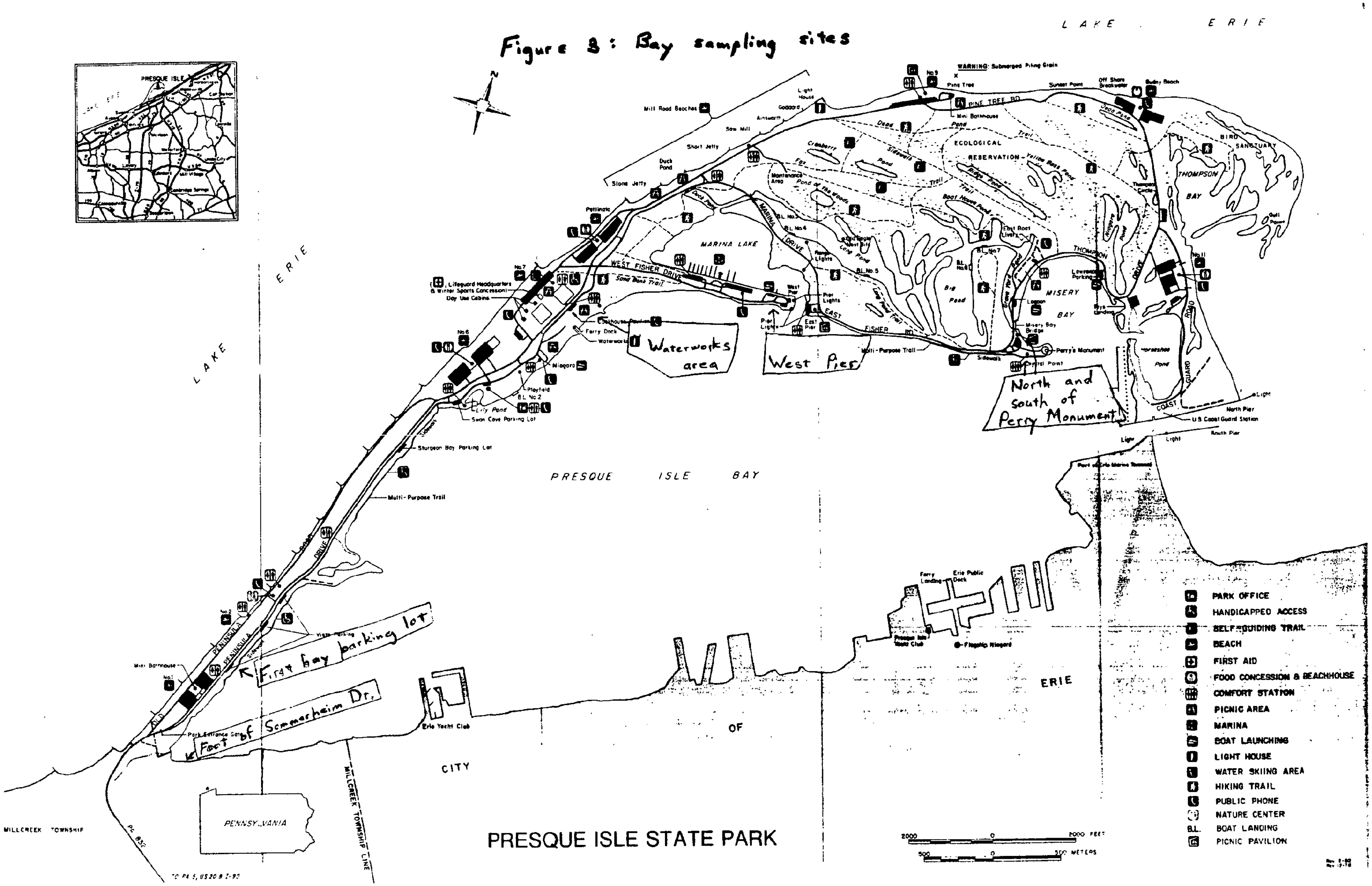

Figure 3: Bay sampling sites

TABLE 7

Bay Samples
Fecal coliform/100 ml.

DATE	FIRST P. LOT	WATER WORKS	WEST PIER	PERRY MON. N	PERRY MON. S
5/9/90	70	<10	20	<10	1000
5/15/90	70	<10	10	<10	20
5/22/90	20	10	30	<10	40
5/30/90	----	<10	<10	10	80
5/31/90	<10	----	----	----	----
6/1/90	10	----	----	----	----
6/6/90	160	30	120	<10	10
6/13/90	250	10	50	<10	<10
6/28/90	300	40	<10	20	10
7/3/90	20	100	<10	20	20
7/11/90	300	<10	20	10	10
7/18/90	----	<10	20	<10	<10
7/25/90	20	<10	<10	<10	10
8/1/90	110	<10	<10	<10	<10
8/8/90	110	<10	20	20	50
8/15/90	100	<10	60	<10	50
8/21/90	70	----	30	----	----
8/22/90	40	50	10	70	<10
8/22/90	50	----	<10	20	<10
GEOMETRIC MEAN	53.5	3.8	8.4	3.7	10.8

closed due to exceeded allowable fecal coliform levels* during the summer of 1990, based on these samples. (Had these sites been bathing areas, however, bacterial levels may have been somewhat higher because of contributions from bathers and resuspension of sediment-associated bacteria from bathers' activities.)

The percentage of samples with ≥200 fecal coliforms/100 ml was used in Table 5 to compare sample results between Presque Isle beaches. In 1991 25.2% of all bathing beach samples collected at Presque Isle had ≥200 fecal coliforms/100 ml. The percentage of samples with ≥200 fecal coliforms/100 ml from the bay control beach areas were as follows:

First Bay Parking Lot	23.4%
Waterworks Area	0
West Pier Area	0
Bay North of Perry Monument	0
Bay South of Perry Monument (one sample over 200)	6.2%

It can be seen that the percentage of high sample values is significantly less at the four control sites not directly subject to non-point source runoff. Differences between these control sites and Presque Isle beaches that could account for different fecal coliform levels include:

*A beach must be closed if the fecal coliform density of any sample exceeds 1,000 per 100 ml, or if the fecal coliform density in not less than five consecutive samples in a 30-day period exceeds a geometric mean of 200 per 100 ml.

- amount of non-point runoff from creeks, streams or storm drain outlets
- relatively calm water in the bay, compared to the lake
- amount of use by bathers
- habits of birds and other wildlife (fewer gulls at the four control areas with low fecal coliform levels; however, ducks are often seen around the Perry Monument area)

VI. County-Wide Lake Erie Sampling

On Tuesday, July 24, 1990, between 12:30 and 2:00 p.m., 19 streams that empty into Lake Erie and 29 beach areas along the Pennsylvania shoreline of Lake Erie from near the Ohio line to the New York State border were sampled (see Figure 4). This effort was similar to the three county-wide sampling events conducted 3 times during 1989 (2). Samples were collected by Presque Isle interns for the Presque Isle beaches, and by ECDH environmental personnel for the streams and beaches in other parts of the county.

The day was sunny and clear with winds from the west. Wave heights were one foot or less in most locations and lake water temperatures were approximately 70^{o}F. There had been no rain since July 22, when there was 0.3 in. of precipitation.

Stream fecal coliform counts were mostly low, as was expected for dry weather conditions (Figure 4). The exceptions were Mill Creek and Garrison Run, which had counts of >6,000 fecal coliform/100 ml. (Laboratory dilutions to detect exact fecal coliform levels above 6,000/100 ml were not prepared; therefore, actual levels are not known.) These streams have combined sewer overflows and some dry weather sewage overflows as tributaries.

Beach water fecal coliform levels were low along the County's Lake Erie shoreline. Beach water fecal coliform levels reported for Presque Isle beaches at the

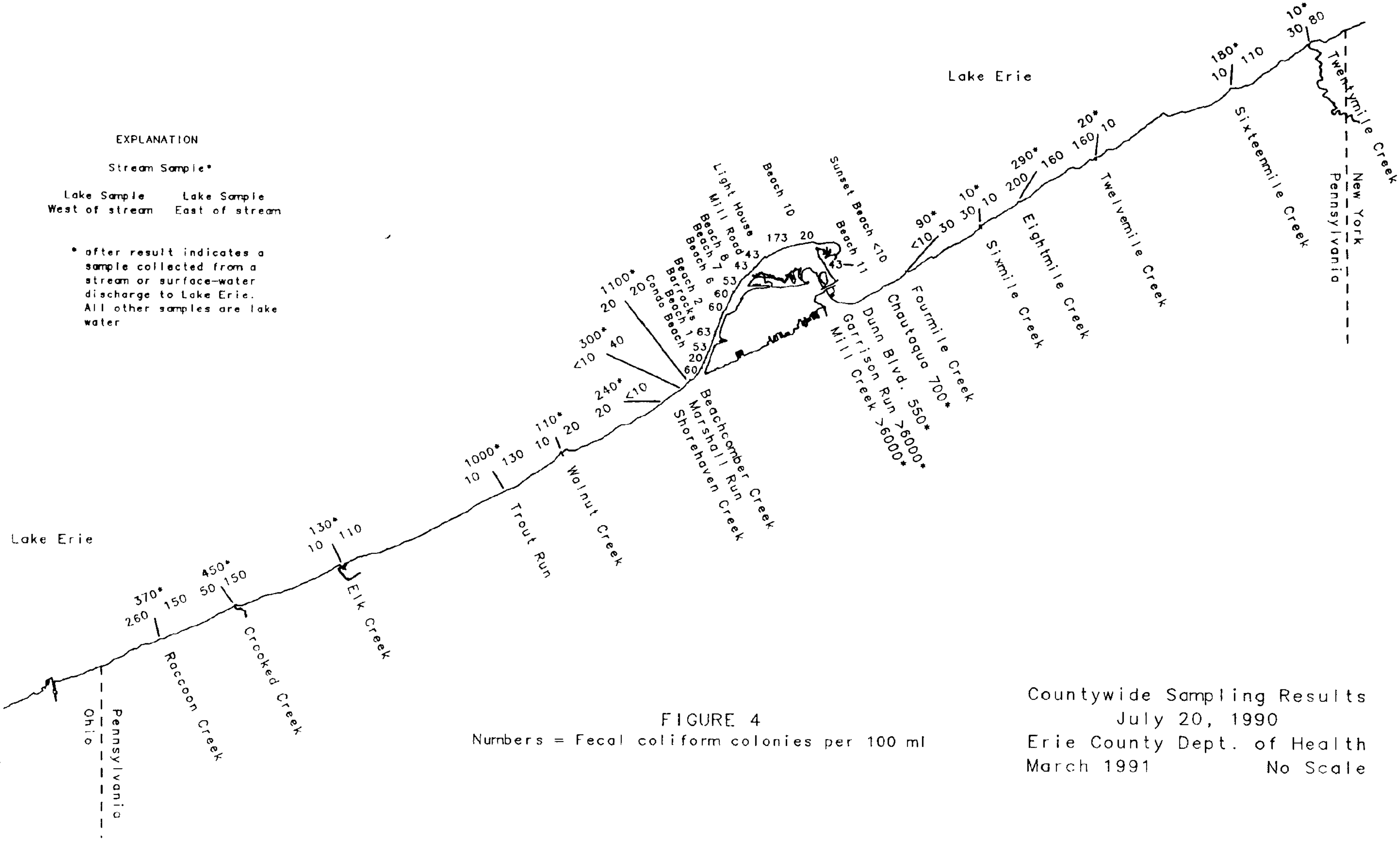

FIGURE 4
Numbers = Fecal coliform colonies per 100 ml

Countywide Sampling Results
July 20, 1990
Erie County Dept. of Health
March 1991 No Scale

time of the survey are noted on Figure 4. They are the arithmetic averages of the three samples collected for each beach, as is outlined in the Protocol for Sampling Beaches in Appendix A. Individual fecal coliform sample levels for each beach can be found in Appendix B.

The arithmetic mean of individual beach samples collected at Presque Isle was 57.5 fecal coliforms/ 100 ml, compared with 63.0 fecal coliforms/100 ml for those collected off Presque Isle. The geometric mean of the individual Presque Isle samples was 43.8/100 ml, compared with 25.7/100 ml for samples off Presque Isle. It does not appear that there were any great differences in fecal coliform levels at Presque Isle State Park versus the remainder of the Pennsylvania section of the Lake Erie shoreline on this day under the weather conditions that existed during sampling.

VII. Incubation Tests of Shoreline Materials

In the Year 1 and Year 2 Bathing Beach Contamination Studies (1,2) it was demonstrated that E. coli could grow under laboratory conditions in shoreline sand obtained from Presque Isle. This concurred with the work of others (7-12,15) who found that E. coli can survive for extended periods of time in natural conditions or can multiply in sediment under some laboratory conditions. Work for the Year 1 and Year 2 incubation tests was patterned after that done by LaLiberte and Grimes (12) on lake bottom sediment. Of the various materials tested in the Year 2 study (2), fresh upland replenishment sand and Beach 1 sand produced the most growth.

Extensive retesting of various types of sand was not planned for 1990. Three types of sand were tested in May 1990 in an attempt to reconfirm results from the Year 1 and Year 2 studies. "Control" sand was obtained west of Presque Isle from a beach at the foot of Montpelier Avenue. Lake replenishment sand (from Erie Sand and Gravel) and upland replenishment sand (from West Ridge Sand and Gravel) were also tested. Lake water was collected to use in the incubation tests.

Samples were processed as was outlined in the Year 1 and Year 2 studies (1,2). The following combinations of each of the three sand samples were prepared:

1. 10 g autoclaved sand + 90 ml lake water
2. 10 g sand + 90 ml lake water
3. 10 g autoclaved sand + 90 ml lake water + E. coli*
4. 10 g sand + 90 ml lake water + E. coli*
5. Lake water as received
6. Lake water with E. coli
7. 10 g sand + 90 ml deionized sterile buffered water
8. 10 g autoclaved sand + 90 ml deionized sterile buffered water
9. 10 g autoclaved sand + 90 ml autoclaved lake water
10. 10 g sand + 90 ml autoclaved lake water

Increases in fecal coliform levels through the second or third day of the experiment occurred in the sand samples spiked with E. coli for the control sand and lake replenishment sand. An increase in the second day was also noted for the lake water spiked with E. coli. (Previous ECDH tests on lake water showed steady declines in fecal coliform with no increases.) No other sand samples showed any appreciable evidence of growth, as was seen in our Year 1 and Year 2 studies.

Results of the upland sand sample incubation tests were quite different from those in the Year 2 study. All sand incubation samples tested in 1990 had very low fecal coliform levels, most of which were <10 fecal

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*One loopful of an E. coli culture slant was aseptically transferred to 100 ml of sterile buffered water; .1 ml of this mixture was used where indicated.

coliforms/100 ml. Even inoculation of sand samples with _E. coli_ did not produce an appreciable quantity of _E. coli_ in tests run immediately after the inoculation. (Inoculation of lake water with _E. coli_ in this experiment resulted in a fecal coliform level of 560/100 ml.) The experiment was repeated using the same sand sample, with virtually the same results. It would appear that there was some difference in this upland sand sample which was detrimental to the survival of _E. coli_. Results follow in Tables 8 - 10.

TABLE 8

Incubation Test

Control Sand

(from foot of Montpelier Avenue)

		Fecal Coliform/100 ml				
		Day 1	Day 2	Day 3	Day 4	Day 5
1.	10 g autoclaved sand + 90 ml lake water	20	50	40	20	<10
2.	10 g sand + 90 ml lake water	<10	10	<10	<10	<10
3.	10 g autoclaved sand + 90 ml lake water + *E. coli*	790	16,000	30,000	3,000	1,000
4.	10 g sand + 90 ml lake water + *E. coli*	770	6,000	1,700	400	2,800
5.	Lake water as received	<10	<10	<10	<10	<10
6.	Lake water with *E. coli*	550	3,000	2,000	500	100

TABLE 9

Incubation Test

Upland Replenishment Sand

(from West Ridge Sand and Gravel)

		Fecal Coliform/100 ml				
		Day 1	Day 2	Day 3	Day 4	Day 5
1.	10 g autoclaved sand + 90 ml lake water	<10	<10	20	<10	20
2.	10 g sand + 90 ml lake water	<10	10	<10	<10	<10
3.	10 g autoclaved sand + 90 ml lake water + *E. coli*	20	10	<10	<10	<10
4.	10 g sand + 90 ml lake water + *E. coli*	<10	<10	<10	<10	<10
5.	Lake water as received	<10	<10	<10	<10	<10
6.	Lake water with *E. coli*	550	3,000	2,000	500	100

TABLE 10

Incubation Test

Lake Replenishment Sand

(from Erie Sand and Gravel)

		Fecal Coliform/100 ml				
		Day 1	Day 2	Day 3	Day 4	Day 5
1.	10 g autoclaved sand + 90 ml lake water	120	60	110	<10	<10
2.	10 g sand + 90 ml lake water	110	150	100	20	<10
3.	10 g autoclaved sand + 90 ml lake water + *E. coli*	470	5,000	4,000	420	180
4.	10 g sand + 90 ml lake water + *E. coli*	560	6,000	3,000	490	290
5.	Lake water as received	60	90	10	<10	<10
6.	Lake water with *E. coli*	510	2,000	340	20	<10

VIII. Sand Raking Trial

In the Year 1 report (1), a bathing beach on a small recreational lake in Madison, Wisconsin was discussed (15). This beach had problems resulting from high fecal coliform levels in wet shoreline sand. Bathing beach water experienced elevated bacterial counts (and frequent beach closings) when adverse weather (rain or wind) led to suspension of this material from the shoreline into the lake. In further correspondence with the City of Madison Health Department and the University of Wisconsin, it was learned that bacterial levels were being controlled by daily discing (turning over) of damp shoreline sand. Turning the sand over allowed more of it to be exposed to air and sunlight. The sand dried and fecal coliform levels were reduced. This program resulted in a significant reduction of beach closures for the Madison beach.

This year's activity included raking damp sand at one Presque Isle beach to determine whether this procedure might be effective on the Presque Isle shoreline. Sawmill Beach was selected as the test site. Short Jetty Beach (west of Sawmill) and Ainsworth Beach (east of Sawmill) were used as control sites. Periodic samples of damp sand and lake water were collected to assess the effectiveness of the program.

On July 18, 1990 samples of sand were collected for fecal coliform analysis at the test sites for background levels. On Thursday, July 19 pre-raking samples of sand and water were collected from 7:00 - 8:00 a.m.

Sawmill Beach was raked about 7:30 - 8:00 a.m. with a bulldozer with a scarifier. The bulldozer made two passes, raking an area 6 - 8 feet wide at the water's edge to a depth of 3 - 4 inches. The entire length of the beach (approximately 800 feet) was raked.

Sawmill Beach sand was re-sampled immediately following the raking, and periodic samples of test and control sand and water were collected throughout the day (Table 11). Sand was also re-sampled three days after raking.

Fecal coliform results in Table 11 do not show a particular pattern or significant differences between test and control beaches. Some of the higher sand counts were from samples collected during (or immediately after) times when a large number of gulls were occupying the shoreline area. It was not shown that raking had any significant effect on fecal coliform levels during this trial.

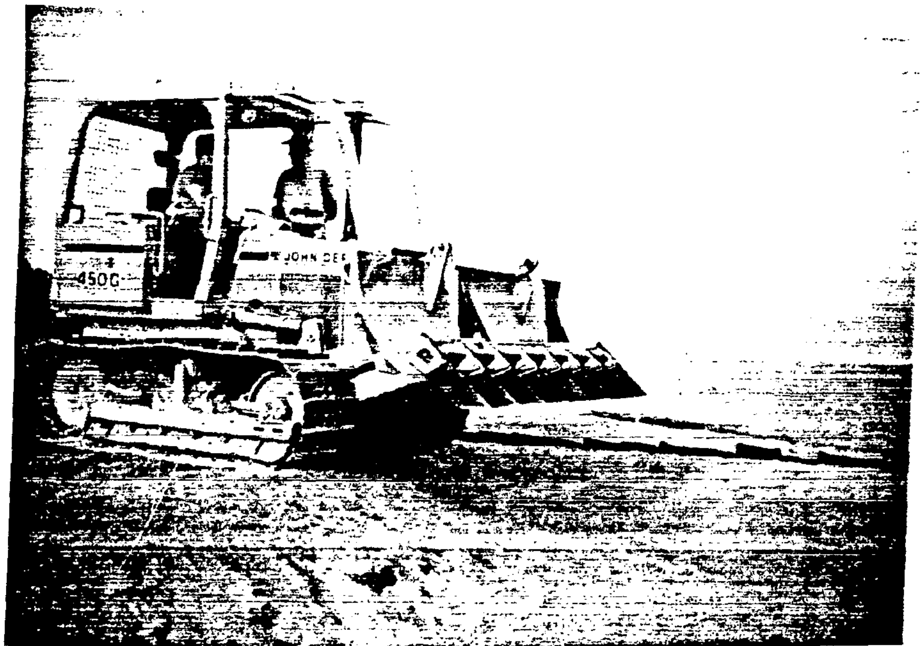
Some problems with the raking trial were:

1. The most effective equipment for the program was not available. The bulldozer ran over the raked area, flattening part of the area with

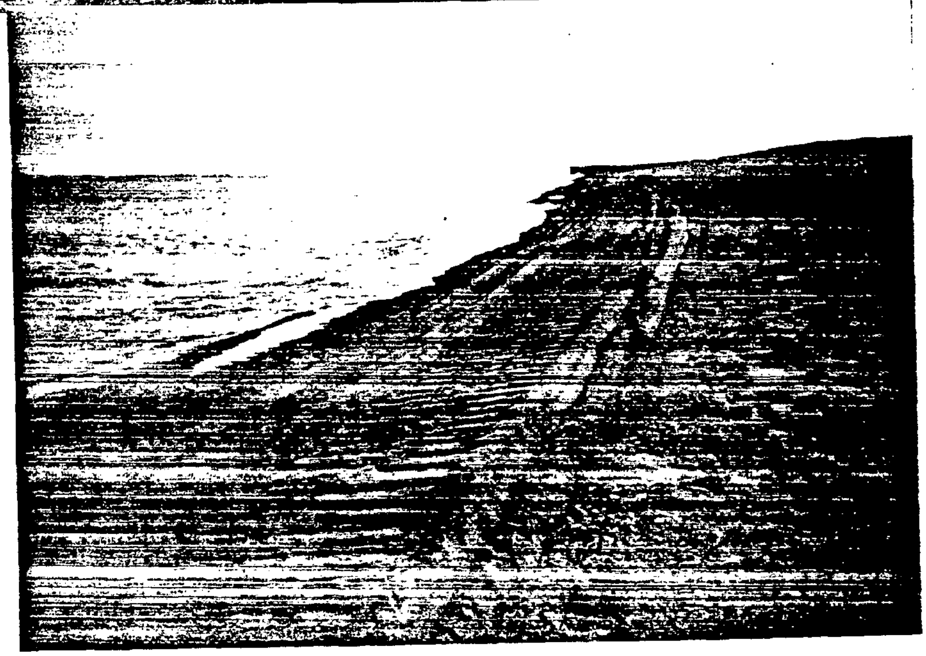
its tracks. Different equipment may have produced better results, had the weather remained calm all day.

2. Although the lake was calm in the morning, waves increased in the early afternoon and flattened the raked area. It was then identical to the control areas in appearance. Changes during a day, such as occurred on July 19, are usual rather than an exception.
3. There were few periods of time with ideal conditions for the raking trial (i.e., 3-4 days of hot, calm weather). It was also difficult to predict when such a period of time would occur.
4. Lake Erie water level can vary considerably due to seiches (tide-like occurrences driven by wind). A seiche would temporarily change the location of the shoreline, thereby reducing the effectiveness of the program. A seiche is not believed to have occurred during the July 19 trial.

Although the raking program could be tried again in the summer of 1991, it does not appear to hold much promise for Presque Isle's lake side bathing beaches because of changeable lake conditions. The program might work at a small inland lake or an area such as Beach 11, which is sheltered and is usually calm.



Sand raking trial
July 19, 1990



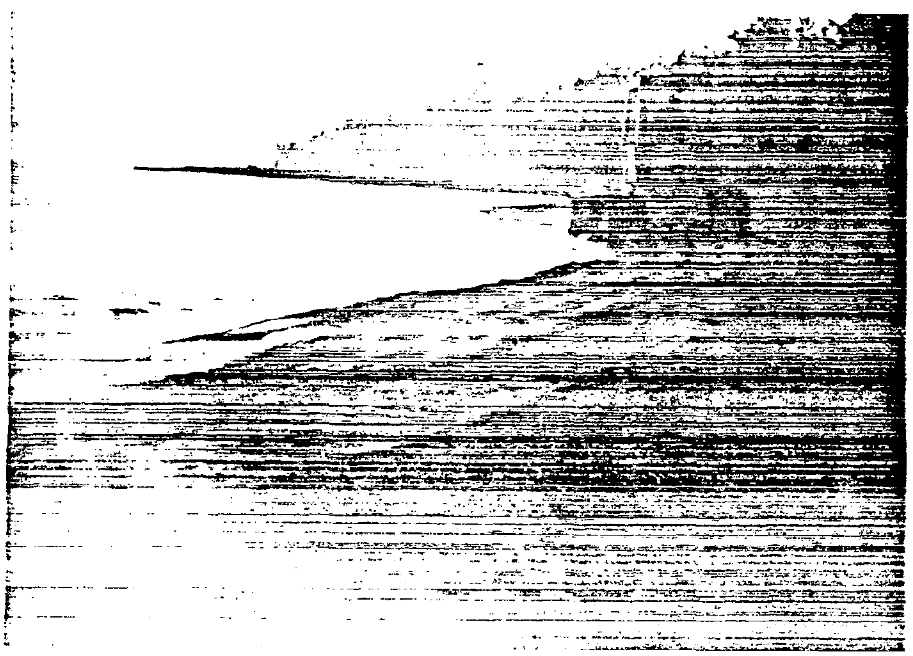


TABLE 11

Date	Time	SAND SAMPLES Fecal Coliform/10 g				WATER SAMPLES Fecal Coliform/100 ml		
		Short Jetty	Sawmill West	Sawmill East	Ainsworth	Short Jetty	Sawmill	Ainsworth
7/18/90	12:00	4,000	---	460	20	---	---	---
7/19/90	7:00	---	---	300	---	---	---	---
7/19/90	8:00	20	---	4,300	20	20	300	20
7/19/90	10:00	170	80	700	20	---	---	---
7/19/90	13:00	1,000	1,400	2,300	60	80	60	160
7/19/90	15:30	<10	200	200	<10	---	---	---
7/19/90	20:00	800	110	60	200	60	180	30
7/22/90	13:40	100	300	200	<100	---	---	---

IX. Predictive Beach Closings

As a result of the first two years of this study (1,2) it was found that it is possible to predict the detection of high fecal coliform levels at Presque Isle bathing beaches with a good degree of accuracy. These predictions are based on weather and lake conditions. The following conditions were found to cause elevations in beach water fecal coliform levels, which were likely to approach or possibly exceed 1,000/100 ml.*

1. The onset of a windstorm and rough lake conditions following several days of hot, calm weather - Fecal coliform bacteria appear to accumulate and grow in shoreline sand during the hot, calm weather and are suspended in the water at the onset of rough weather. These conditions may affect any of Presque Isle's lake-side beaches.
2. A heavy rainstorm, together with lake currents from the west - Non-point source runoff affects Beach 1 and Barracks Beach because of proximity to those sources. Other beaches may also be affected, but fecal coliform levels at other Presque Isle beaches are not as likely to be high enough to warrant beach closings. A

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*A beach must be closed if a single sample exceeds 1,000 fecal coliform/100 ml or if the monthly geometric mean exceeds 200 fecal coliform/100 ml.

rainstorm, together with currents from the east, may produce high fecal coliform levels at Presque Isle's Beaches 10 and 11, but at this time it is not possible to predict, with any degree of accuracy, whether these levels might approach those requiring a beach closing under any given set of circumstances. Municipal sewer system malfunctions may allow discharges into streams or directly into the lake. Such a malfunction is most likely to occur during heavy rain, and if it occurs, may exacerbate contamination incidents at Presque Isle beaches.

3. Lack of chlorination or incomplete chlorination of the City of Erie sewage treatment plant effluent - No malfunctions of this type were recorded for the summer of 1990. If such an event was to occur, preventative closing of Beaches 10 and 11 may be warranted because currents could carry sufficient effluent to those beaches to cause elevated fecal coliform levels. If it happen,s it may cause high fecal coliform levels at Beach 10 and Beach 11.

Fecal coliform levels resulting from any of these conditions may last from several hours to a day or more. However, laboratory analysis of a water sample takes 24 hours (48 hours for Sunday samples). In the absence of instantaneous bacteriological data, swimming might be permitted during the time that fecal coliform levels are highest. By the time the sample analyses are completed and a beach closed, water quality has usually improved to within levels considered "safe" for swimming. Improvements were needed, both to safeguard public health and to prevent needless days of beach closures under acceptable water quality conditions.

Generally speaking, changes in beach sampling and closing protocols made over the years were improvements in that more samples were being taken, more areas sampled and some precautionary beach closings were beginning to take place. However, beach designations, numbers of samples collected and interpretation of results varied from year to year or even from month to month. Increased beach closings caused by these changes resulted in a great deal of confusion for the public, who felt that increased closings indicated worsening pollution.

Presque Isle State Park addressed these problems in the spring of 1990 by writing a sampling protocol to standardize and outline sample collection sites and procedures, as well as methods used in interpretation of results. Provisions were also made to close a beach as a precautionary measure if high fecal coliform levels were predicted (as in #1, 2 and 3 above). The protocol was developed in close cooperation with Pennsylvania

Department of Environmental Resources, Bureau of Community Environmental Control to assure that state regulations were being properly interpreted.

Predictive closings in 1990 are believed to have reduced health risks to the public. Presque Isle State Park plans to continue using predictive closings, as needed, in the future.

The Presque Isle State Park sampling protocol is included as Appendix A. Table 12, which was developed by Presque Isle State Park, lists the precautionary (predictive) closings which occurred in 1990, as well as total beach closures and percentage of time closed for each beach.

TABLE 12

PRESQUE ISLE STATE PARK
1990 REGULAR SWIMMING SEASON

BEACHES COL 1	DAYS BEACH OPEN COL 2	DATES BEACH CLOSED HIGH COLIFORM COL 3	# DAYS BEACH CLOSED HIGH COLIFORM COL 4	% TIME BEACH CLOSED HIGH COLIFORM COL 5	TOTAL # TIMES BEACH CLOSED HIGH COLIFORM COL 6	# TIMES BEACH CLOSED AS A PRECAUTION (INCLUDED IN COL. 6) COL 7
#1 West	93	6/19 -6/23/90 7/31 -8/02/90 8/29 -8/31/90	8	7.9%	3	1
#1	93	6/19 -6/23/90 7/31 -8/02/90 8/29 -8/31/90	8	7.9%	3	1
#1 East	95	6/19 -6/20/90 7/18 -7/19/90 8/07 -8/10/90 8/29 -8/30/90	6	5.9%	4	2
Barracks	95	6/19 -6/20/90 7/18 -7/19/90 8/07 -8/10/90 8/29 -8/30/90	6	5.9%	4	2
#2	100	6/19 -6/20/90	1	0.99%	1	
#6	101		0			
#7	100	7/31 -8/01/90	1	0.99%	1	
#8	101		0		0	
Stone Jetty	101		0		0	
Duck Pond	101		0		0	
Short Jetty	101		0		0	
Saw Mill	101		0		0	
Ains-worth	101		0		0	
Goddard	101		0		0	
Light-house	101		0		0	
#9	101		0		0	

BEACHES COL 1	DAYS BEACH OPEN COL 2	DATES BEACH CLOSED HIGH COLIFORM COL 3	# DAYS BEACH CLOSED HIGH COLIFORM COL 4	% TIME BEACH CLOSED HIGH COLIFORM COL 5	TOTAL # TIMES BEACH CLOSED HIGH COLIFORM COL 6	# TIMES BEACH CLOSED AS A PRECAUTION (INCLUDED IN COL. 6) COL 7
#10	99	8/07 -8/08/90 8/14 -8/15/90	2	1.98%	2	
#11	96	8/14 -8/15/90 8/19 -8/22/90 8/29 -8/30/90	5	4.95%	3	1
TOTAL	1781		37	2.04%	21	7

1818 Total beach days for the regular swimming season which runs from the Saturday of Memorial Day weekend (May 26, 1990) to and including Labor Day (Sept. 3, 1990).

101 Total beach days per beach for the regular season.

X. Summary and Recommendations

The Year 3 Contamination Investigation differed from the Year 1 and Year 2 studies in that the focus of the work shifted from Presque Isle to non-point sources off Presque Isle.

The following observations, conclusions and recommendations were made as a result of this year's work.

Non-Point Sources and Point Sources West of Presque Isle

It appears that much of the fecal coliform affecting Presque Isle beaches are transported into Lake Erie by storm water. Literature and sampling conducted thus far both indicate that stream, storm drain and catch basin sediments are reservoirs of fecal indicator bacteria which are resuspended in storm water and carried to Lake Erie during heavy rain events. Depending on lake current conditions, high fecal coliform levels at some Presque Isle beaches may result soon after a rain event.

Many of the fecal bacteria eventually settle into lake sediments or are washed into sand in the "splash zone" area of the beaches, where it has previously been shown that bacterial incubation may take place (1,2). Wind and waves can suspend these fecal indicator bacteria, resulting in high bacterial levels in beach water (1,2).

Indications are that most of the fecal coliforms in this system originate from non-point sources in the watershed area. Though sewer overflows are infrequent in the area west of Presque Isle, when they do occur they also add fecal indicator bacteria to the stream/storm drain sediment system.

The following recommendations are made towards the goal of controlling and/or predicting health risks in Presque Isle bathing waters which originate from point and/or non-point sources west of Presque Isle.

1. Though sewer overflows west of Presque Isle do not appear to be frequent, overflows will add to fecal indicator bacteria and nutrients in sediments and contribute to increased lake water bacterial levels not only immediately but possibly even weeks after it occurred.

   It is recognized that the Millcreek Township Sewer Authority is planning a complete renovation of the Shorehaven Drive sewage pump station before the spring of 1991. This should eliminate one infrequent intermittent source of sewage.

   It is recommended that the Township also determine what repairs are necessary to prevent a recurrence of the sewer overflow incident at Kelso Beach on August 29, 1990 and to determine what improvements might be needed for the Route 5 sewage lift station on Wilkins Run.

Millcreek Township should also give a high priority towards locating and eliminating sources of inflow and infiltration to those portions of the sanitary sewer system that could adversely affect Presque Isle State Park.

It is recommended that the Fairview Township Sewer Authority look closely into operation records for its Manchester Road sewage pump station. The Authority should determine if additional upgrades in the system are necessary to prevent unpermitted bypasses.

All municipalities in Pennsylvania are required by law to immediately report any unpermitted sewage discharge. Knowing when and where such events occur on streams that empty into Lake Erie in the proximity of Presque Isle allows for the timely closing of beaches. These records also support the need to upgrade inadequate systems. Enforcement actions should occur when it is determined that an accidental or illegal discharger is negligent in reporting an unpermitted discharge.

2. Municipalities with known areas of septic problems should update their 537 plans to include those areas in future sewer projects.

3. Increased sewage flow during rainstorms is often indicative of inflow and or infiltration of storm water into the sanitary sewer. All local municipalities should request the public's help in cutting down on inflow. A public education project should be initiated suggesting that residents check to determine whether their own residential downspouts and footer drains are discharging to the proper locations and to check for leaky basements. (Rain water entering a basement will probably run to the laundry sewer, adding to sanitary sewer flows.) Proper action should be taken to eliminate such problems.

   The responsibility of protecting the environment rests not only with various government agencies, but also in the hands of the general public.

4. An ordinance requiring pet owners to pick up their pets' wastes in a small beach town in New Jersey was helpful in reducing fecal indicator levels in beach water. Pet owners should be encouraged to pick up after their pets, particularly on or near paved areas leading to storm drains.

   This item is covered, in general, under the Rules and Regulations of the Pennsylvania Department of Environmental Resources, Chapter 243, Nuisances, Section 243.9. Public acceptance and cooperation is needed in order to meaningfully cut down on the bacterial runoff from domestic pets' wastes.

It is recommended that Presque Isle State Park continue to enforce its policy prohibiting dogs on guarded bathing beaches and consider imposing "littering" fines on dog owners who do not pick up after their pets on unguarded beaches.

5. Periodic cleaning of streets, ditches, storm drains and catch basins may help to reduce fecal indicator bacteria in storm water. A study is being formulated for 1991-92 to determine whether there may be beneficial effects from frequent cleaning of a portion of a storm sewer system. Storm water and sediment from the study area and a control area will be compared to determine the effectiveness of the cleaning operations in removing fecal coliform. It is recommended that this plan be carried out.

6. A new storm water management plan is to be developed for the Lake Erie watershed in Erie County. It is anticipated that work on the plan will begin in the spring of 1991. It is recommended that municipalities implement this

storm water management plan after its development. Any reductions in storm water quantities might be expected to result in reductions in non-point bacteria reaching Lake Erie.

7. It is recommended that the DER continue the breakwater monitoring program established in 1989. One goal should be to determine whether the breakwaters in place at Barracks Beach and Beach 1 East may, under some conditions, slow or retain fecal indicator bacteria associated with water or sediment from streams and storm drains to the west.

8. Investigations have revealed that most of the fecal indicator bacteria in storm water west of Presque Isle are of non-point origin. These bacteria may have survived for a prolonged period of time and possibly multiplied in the environment. Therefore, human health risks associated with swimming may differ from those expected for a given indicator level of fecal coliform. If so, beach closing mechanisms for bathing beaches would need to be reviewed and should be appropriately revised.

   It is recommended that storm water, storm drain sediment, Beach 1 water and Beach 1 sediment be analyzed for select human and animal pathogens in future studies. Based on the results, other water and sediment samples may also be tested for pathogens and a relative health risk estimated for a particular fecal coliform (or other indicator) level.

Sewerage Overflows East of Presque Isle

Sanitary sewer overflows from sources east of Presque Isle could possibly affect Presque Isle Beaches 10 and 11 under certain lake conditions. The following recommendations are made concerning these overflows.

1. Some of these overflows (discussed in Section II) do not seem to be adequately emphasized by the 1990 consent decree between the City of Erie and the Pennsylvania DER. It is recommended that all of these sites be included in any cleanup plan formulated as a result of the consent decree.
2. It is recommended that the DER consider a connection ban prohibiting all municipalities from making any new sewerage connections to the City of Erie's east side interceptor sewer until the overflow problems are resolved.

Additional Findings and Recommendations

1. Evidence gathered during this study shows that levels of fecal coliform bacteria at selected sites on the Presque Isle side of the bay meet the requirements of the Public Bathing Place Regulations.

2. A sand raking trial at one of Presque Isle's lake side beaches was not successful in reducing fecal coliform levels in the damp shoreline sand zone, probably because of quickly changing lake levels and conditions.

3. Growth of E. coli was seen in some of the sand samples during incubation tests of shoreline materials. Contrary to Year 2 results, however, the upland sand sample would not support growth or even survival of E. coli. No definite conclusions can be made from this one upland sand sample. At this time, plans are to discontinue use of upland sand for beach replenishment once the breakwater construction project is complete.

4. The Protocol for Sampling Beaches developed by Presque Isle State Park appears to be a useful tool in protecting the public from exposure to possible high pathogen levels in bathing beach waters, while preventing at least some closures

that might have occurred in the past under acceptable water quality conditions. It is recommended that Presque Isle State Park continue to use this Protocol and to improve on it as new information and experience warrant such changes.

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APPENDIX A

Presque Isle State Park
Protocol for Sampling Beaches

Rev. 6/08/90

PROTOCOL FOR SAMPLING BEACHES

Below is the protocol for sampling the beaches at Presque Isle State Park that will be implemented for the 1990 swimming season.

Samplers will consist of a trained student intern team (2 each) who will be responsible for all sample collection, lab delivery, and input of sample data on a computer. The samplers will be trained by the Erie County Department of Health and park officials prior to the swimming season.

Regulations samples will be taken between noon and 2:00 p.m. on Sundays and Mondays during the swimming season. Samples will not be collected prior to the swimming season. Three separate samples will be taken at each of the 11 permitted beach areas as delineated on the Presque Isle Bathing Permit which was filed with the Department of Environmental Resources Community of Environmental Control in 1957 (two permitted beach areas are no longer used for swimming). One sample will be taken approximately 50'in from each end of the beach, and the third will be taken in the center of the beach area. All three samples will be taken during the same visit to the beach and will not be spread throughout the day. All samples will be taken at the average water depth of the beach (approximately waist high). The lab will run separate tests for each of the three samples taken at each beach area. The final count for that particular beach will be the arithmetic mean of the three samples. This final count will be referred to as a sample throughout this protocol. Sporadic high anomalies will not be included in the arithmetic mean to determine the final beach count but the anomaly will be reported to the park. Attempts will be made to determine the cause of that anomaly and resamples may be taken.

The Dean and Dixon Q-test will be used to determine statistically if a anomaly has occurred. This test relates the extreme sample range to the range between the suspect result and its nearest neighbor. If properly applied, the Q-test results in a 90% confidence level for data rejection. It should be noted that the Q-test will only be judiciously applied when the laboratory suspects an anomalous sample result. It would not be employed to routinely discard the highest of the three sample results. Since the statistical analysis of small ie., 3 sample, data sets is difficult, coliform counts from adjacent beaches will be included in this analysis when possible. Exceptions would be Beach 1 West and Beach 11 North.

The sample results will be incorporated into a 30-day running geometric mean which will be calculated for each beach. The DER Lab in Erie is responsible for calculating the geometric mean.

The 30-day running geometric mean is based on samples taken during the last 30 days and is not based on a calendar month. A minimum of five samples taken on five different days are necessary to run the geometric mean. Samples taken on the first day of the swimming season will start the 30-day running geometric mean.

Samples taken on Sunday will be refrigerated and taken to the DER lab in Erie at 8:00 a.m. on Monday morning where they will be processed immediately. Samples taken on Monday will be taken to the Lab immediately after collection. Scheduled water samples will not be taken if the beaches are closed because of high wave activity, but samples will be taken the following day or when the beaches are reopened.

For beach closing/opening, the lab will be responsible for immediately notifying one of the following persons at Presque Isle State Park: 1) Park Operation Supervisor I, 2) Assistant Superintendent in charge of lifeguards and 3) Assistant Superintendent in charge of Park's Police; and one of the following persons at the Erie County Department of Health: 1) Director of Environmental Health, 2) Environmental Health Supervisor, 3) Director of Health Department, or 4) Aquatic Biologist. Presque Isle State Park must contact the Erie County Department of Health for approval to reopen beaches closed for conditions 1, 2, 3 as outlined in the "Closing a Beach Section."

The park will also be responsible for contacting following any beach closure/opening: the Lifeguard Headquarters, the Presque Isle Police (so they can log the beach closure/opening in), Gateway Concession, Region #2, and the Chamber of Commerce.

CLOSING A BEACH

The water in bathing beaches should be considered contaminated for bathing purposes when one of the following conditions exist:

1. When officials determine (through visual inspection) that a substance is being discharged or may be discharged into the water and is or may be hazardous to the health of persons using the bathing beach. The beach will be closed and sampling will begin to determine the coliform count. Samples taken during the time the beach is closed because of this type of closure will not be counted towards compliance and will not be included in the 30-day running geometric mean.

2. When the fecal coliform density of any sample collected at a bathing beach exceeds 1,000 per 100 milliliters.

3. Whenever the 30 day running geometric mean fecal coliform density of all samples exceeds 200 per 100 ml.

4. If the first few sample results taken at the start of the swimming season are greater than 500 per 100 ml, the beach should be closed until the running geometric mean, using a minimum of 5 samples, is less than 200 per 100 ml.

5. Beaches may be closed at the onset of high wave activity immediately following a hot, calm period of weather in anticipation of high fecal coliform counts. Historical data has indicated that during these conditions that a high fecal coliform count will be experienced immediately at the onset of high wave activity with the levels decreasing back to safe standards within several hours. The beaches may be reopened two hours after closure for this condition if the waves are not creating unsafe swimming conditions. Samples will be collected during this type of closure only for additional data to monitor and verify if this procedure is correct.

   Samples taken during this condition will not be considered "regulatory" and are not included as part of the 30-day running geometric mean. If samples taken when beaches are reopened and found to exceed 200 per 100 ml, indicating assumption for reopening was not valid, future reopening will not be allowed until confirmation of a level not more than 200 fecal coliform per 100 ml is received.

OPENING BEACHES

After a bathing beach has been closed due to conditions 1, 2, and 3 as stated above under "Closing a Beach", a re-sampling of the bathing beach will occur for five consecutive days, weather conditions and lab operations permitting (the lab is closed on Saturdays and Sundays). Bathing beaches will be reopened after closure when a visual survey of the beach area indicates the conditions which were responsible for the closure are no longer present and when:

1. The first re-sample after the closure which does not exceed 200 fecal coliform per 100 ml. The sample which closes a beach because of conditions 2 and 3 as stated above will be included in the 30-day running geometric mean. Samples taken while the beach is closed will also be incorporated in the 30 day running geometric mean.

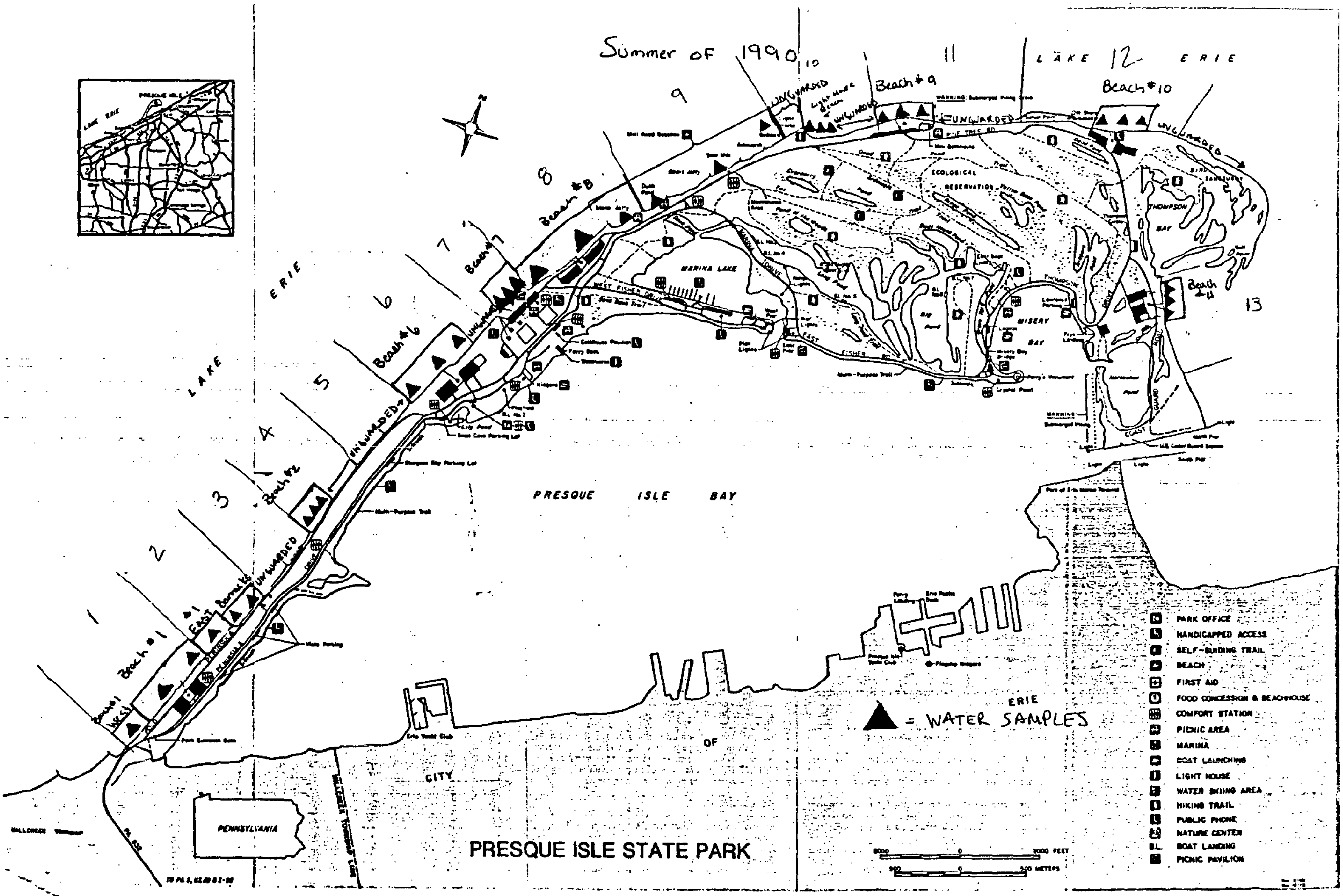
2. If the conditions responsible for closing the beach cannot be identified the beach may not be reopened until the 30-day running geometric mean does not exceed 200 fecal coliform per 100 ml.

   During the summer of 1990, the Erie County Health Department will be continuing the sampling of beaches for the ongoing "Beach Contamination Study" at Presque Isle State Park.

   Samples taken for this study during open beach hours and at designated swimming beaches will only be considered as regulatory samples if the protocol outlined previously is followed. For those samples, Sue or her designee will indicate on the sample form "Regulatory", and the DER Lab will handle these samples as previously indicated and include the samples into the running 30-day geometric mean.

NOTIFY THE FOLLOWING FOR ANY BEACH CLOSING OR OPENING:

1. Erie County Health Departement - - - - - - - - - - - 451-6700
   (Joe Vogel, Mark Fedorchak, Joseph Trzybinski or Bob Wellington)
2. Lifeguard Headquarters - - - - - - - - - - - - - - - - 838-6804
3. Park Police
4. Park Region #2 - - - - - - - -- - - Network- - - 8 -686-3080
5. Central Office - - - - - Wendy - Network- - - 8 -447-6640
6. Gateway Concessions (John Loyer) - - - - - - - 453-7787
   (Call for #6, Pettinato, Budny and #11)
   (Beeper 453-0938 - when it beeps give our # - They will call us back)
7. Chamber of Commerce - - - - - - - - - - - - - - - - - 454-7191
   (Bob Chandler, Don DiPlacido or Judy)
8. WICU-TV (Ch. 12) - - - - - Evan Lovett - - - - - - 454-5201
9. WJET-TV (Ch. 24) - - - - - Marsha) - - - - - - - 868-2424
10. WSEE-TV (Ch. 35) - - - - - Pierre - - - - - - - - 455-7575
11. Erie Times News - - - - - - - - - - - - - - - - - - - 870-1715
12. Erie Morning News - - - - - - - - - - - - - - - - - - 870-1682
13. Rocket 101 - - - - - - Chris - - - - - - - - - - 725-4000
14. WEYZ Radio - 452-2041
    (Ask for Jim or Chris Tarbell)


Summer of 1990
PRESQUE ISLE STATE PARK
LAKE ERIE
PRESQUE ISLE BAY
CITY OF ERIE
= WATER SAMPLES
Beach #1
East Beach #1
Beach #2
Beach #6
Beach #7
Beach #8
Beach #9
Beach #10
Beach #11
Light House Beach
UNGUARDED
1
2
3
4
5
6
7
8
9
10
11
12
13
MARINA LAKE
MISERY BAY
THOMPSON BAY
ECOLOGICAL RESERVATION
WEST FISHER DR
EAST FISHER RD
PENNSYLVANIA
PARK OFFICE
HANDICAPPED ACCESS
SELF-GUIDING TRAIL
BEACH
FIRST AID
FOOD CONCESSION & BEACHHOUSE
COMFORT STATION
PICNIC AREA
MARINA
BOAT LAUNCHING
LIGHT HOUSE
WATER SKIING AREA
HIKING TRAIL
PUBLIC PHONE
NATURE CENTER
BOAT LANDING
PICNIC PAVILION
Multi-Purpose Trail
Erie Yacht Club

BEACH SAMPLES FOR 1990 SUMMER SEASON

PERMIT AREA	BEACH SAM. NAME	LOCATION OF BEACH SAMPLES
1	Beach #1	One sample taken at west end of Beach #1-West. Two samples taken at Beach #1 (West of Bathhouse, East end of Beach #1).
2	Barracks	One sample taken at the West end of Beach #1-East. Two samples taken at Barracks Beach (West end, East end).
3	unguarded	No samples taken in this area.
4	Beach #2	Three samples taken at Beach #2 (West end, middle and East end).
5	unguarded	No samples taken in this area.
6	Beach #6	Three samples taken at Beach #6 (West end, middle and East end).
7	Beach #7	One taken at West end of Beach #7. One sample taken midway between West end and concrete jetty. One sample taken at concrete jetty.
8	Beach #8	One sample taken at the East end of Beach #7. One sample taken just east of the Beach #8 concession stand. One sample taken at the east end of Stone Jetty.
9	Mill Rd. Beaches	One sample taken at the west end of Duck Pond Beach. One sample taken at Saw Mill Beach. One sample taken at the east end of Goddard Beach.
10	Light House Beach	Three taken at Light House Beach (West end, middle, East end).
11	Beach #9	Three samples taken at Beach #9 (West end, middle and East end).
12	Beach 10	Three samples taken at Beach #10 (West end, middle and East end).
13	Beach 11	Three samples taken at Beach #11 (West end, middle and East end).

APPENDIX B

Presque Isle State Park

1990 Bathing Beach Sample Results

Presque Isle State Park 1990 Beach Sampling Results

The following table was prepared by the Erie Department of Environmental Resources Laboratory to track sample results and keep a running 30-day geometric mean, per the "Protocol for Sampling Beaches" (Appendix A). The following information will be of use in interpreting the table:

- All counts are reported in units of fecal coliform/100 ml.
- A count of "1" indicates a day when no sample is collected. (The "1" is used as a multiplier and does not affect the 30-day geometric mean.)
- Counts in column "A" are from the west area of the beach sampled (north for Beach 11). Counts in column "B" are from the center area of the beach. Counts in column "C" are from the east area of the beach (south for Beach 11).
- "Mean count" is an arithmetic mean of samples A, B and C for a particular day. The mean count is officially considered to be the "sample" for that beach on that day (per the "Protocol for Sampling Beaches).
- "0/1" : "0" indicates that no sample was taken that day or that the sample was taken for monitoring purposes. Monitoring samples are designated with an "M" in the collection data column. (Monitoring samples are not used in the geometric mean.) "1" indicates that the sample was used in geometric mean calculations.

- "Root" indicates the number of samples in the running 30-day period.
- "Geo Mean" is the running 30-day geometric mean.

BEACH WATER SAMPLES PRIOR TO MAY 26,1990

Date	Beach 1	Beach 6	Beach 8	Beach 10	Beach 11	Wind Dir.	Wave Ht.	Bather Ld	Lake Elev.	Rain?
10/11/1989	30	40	30	10	40		2	ZERO	570.77	
10/18/1989	230	110	100	220	350	NE	2	ZERO	570.56	YES
10/25/1989	10	10	10	10	10	SW	1	ZERO	570.69	NO
10/31/1989	5800	280	290	440	10	NW	4	ZERO	570.99	YES
11/09/1989	30	180	30	10	60	N	5	ZERO	571.22	NO
11/15/1989	40	30	20	20	40	SE	5	ZERO	570.52	NO
11/21/1989	110	140	110	50	30	NE	5	ZERO	570.78	NO
11/29/1989	80	40	80	40	20	NW	5	ZERO	570.85	NO
12/06/1989	40	90	40	30	10	S	1	ZERO	570.46	NO
12/13/1989	10	10	10	10	40	E	0	ZERO	570.29	YES
03/14/1990	10	10	10	10	10	SW	1	ZERO	571.20	NO
03/21/1990	20	10	30	20	10	SW	2	ZERO	571.30	NO
03/30/1990	10	20	10	10	10	SE	0	ZERO	571.21	YES
04/03/1990	10	10	10	10	10	S	0	ZERO	571.48	NO
04/09/1990	10	10	10	10	10	NW	0	ZERO	571.31	NO
04/17/1990	10	10	10	10	10	W	4	ZERO	571.69	NO
04/25/1990	10	10	10	30	10	W	2	ZERO	571.51	NO
05/02/1990	20	10	10	10	20	SW	3	ZERO	571.38	NO
05/09/1990	100	70	130	40	10	SW	1	ZERO	571.43	NO
05/16/1990	10	10	10	10	30	SW	1	ZERO	571.59	NO
05/22/1990	60	40	30	70	60	NE	1	ZERO	571.66	NO

This table gives the results of water samples taken on a weekly basis at designated beach locations on Presque Isle through the fall, winter and spring of 1989-1990. The samples were collected when the lake was not frozen over. Information listed to the right of the Beach #11 column indicates physical beach conditions for that testing date. Samples are tested for fecal coliform and the results listed are in number of fecal coliform colonies per 100 ml of water.

DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1	ERR					
MAY 27 90	2	1	1	1	1	0	0	1.00E+00	ERR					
MAY 28 90	3	10	20	10	13	1	1	1.33E+01	13.33	52	1	LOW	SW	NO
MAY 29 90	4	600	650	760	673	1	2	8.99E+03	94.75	51	3	ZERO	NE	YES
MAY 30 90	5	70	40	40	50	1	3	4.49E+05	76.57	53	1.5	ZERO	W	NO
MAY 31 90	6	10	10	10	10	1	4	4.49E+06	46.03	56	1	ZERO	W	NO
JUNE 01 90	7	1	1	1	1	0	4	4.49E+06	46.03	56	1	ZERO	W	NO
JUNE 02 90	8	1	1	1	1	0	4	4.49E+06	46.03					
JUNE 03 90	9	1	1	1	1	0	4	4.49E+06	46.03	50	4	ZERO	SW	NO
JUNE 04 90	10	1	1	1	1	0	4	4.49E+06	46.03					
JUNE 05 90	11	90	110	90	97	1	5	4.34E+08	53.39	55	2.5	LOW	S	NO
JUNE 06 90	12	30	30	20	27	1	6	1.15E+10	47.56	60	1.5	ZERO	SW	NO
JUNE 07 90	13	10	10	10	10	1	7	1.16E+11	38.06	62	0.5	LOW	NW	NO
JUNE 08 90	14	1	1	1	1	0	7	1.16E+11	38.06					
JUNE 09 90	15	1	1	1	1	0	7	1.16E+11	38.06					
JUNE 10 90	16	30	40	40	37	1	8	4.24E+12	37.88	58	2.5	ZERO	SW	NO
JUNE 11 90	17	50	30	50	43	1	9	1.84E+14	38.45	58	2	LOW	NW	NO
JUNE 12 90	18	1	1	1	1	0	9	1.84E+14	38.45					
JUNE 13 90	19	70	20	200	97	1	10	1.78E+16	42.17	64	1	LOW	W	NO
JUNE 14 90	20	450	400	260	370	1	11	6.58E+18	51.37	58	3	LOW	SW	YES
JUNE 15 90	21	1	1	1	1	0	11	6.58E+18	51.37					
JUNE 16 90	22	1	1	1	1	0	11	6.58E+18	51.37					
JUNE 17 90	23	10	60	30	33	1	12	2.19E+20	49.35	60	0.5	LOW	S	NO
JUNE 18 90	24	4100	4000	3600	3900	1	13	8.55E+23	69.33	59	3	LOW	SW	NO
JUNE 19 90	25	400	400	230	360	1	14	3.08E+26	77.99	64	3	ZERO	W	NO
JUNE 20 90M	26	120	1400	2500	1	0	14	3.08E+26	77.99					
JUNE 21 90M	27	80	130	120	1	0	14	3.08E+26	77.99	66	3	ZERO	SW	NO
JUNE 22 90	28	120	120	110	117	1	15	3.59E+28	80.11	65	0	ZERO	S	NO
JUNE 23 90	29	1	1	1	1	0	15	3.59E+28	80.11					
JUNE 24 90	30	800	200	700	567	1	16	2.03E+31	90.53	66	4	ZERO	NW	YES
JUNE 25 90	31	320	230	190	247	1	17	5.02E+33	96.03	66	3	ZERO	W	NO
JUNE 26 90	32	10	10	30	17	1	18	8.36E+34	87.12	70	1	LOW	W	NO
JUNE 27 90	33	50	30	30	37	1	18	2.30E+35	92.16					
JUNE 28 90	34	10	20	20	17	1	18	5.69E+33	75.04	70	0.5	LOW	NE	NO
JUNE 29 90	35	1	1	1	1	0	17	1.14E+32	76.85					
JUNE 30 90	36	1	1	1	1	0	16	1.14E+31	87.30					
JULY 01 90	37	60	70	70	67	1	17	7.59E+32	85.93	70	2.5	LOW	NW	NO
JULY 02 90	38	10	20	60	30	1	18	2.28E+34	81.05	72	0.5	LOW	SW	NO
JULY 03 90	39	10	100	20	1	0	18	2.28E+34	81.05					
JULY 04 90	40	1	1	1	1	0	18	2.28E+34	81.05					
JULY 05 90	41	30	30	20	27	1	18	6.28E+33	75.45				NE	NO
JULY 06 90	42	1	1	1	1	0	17	2.36E+32	89.21					
JULY 07 90	43	1	1	1	1	0	16	2.36E+31	91.36					
JULY 08 90	44	60	20	140	73	1	17	1.73E+33	90.19	72	1	LOW	W	NO
JULY 09 90	45	1600	410	300	770	1	18	1.33E+36	101.60	72	1.5	LOW	SW	NO
JULY 10 90	1	1	1	1	1	0	17	3.63E+34	107.88					
JULY 11 90	2	10	100	40	50	1	17	4.19E+34	108.79	71	0.5	LOW	N	NO
JULY 12 90	3	1	1	1	1	0	17	4.19E+34	108.79					NO
JULY 13 90	4	1	1	1	1	0	16	4.33E+32	109.59					
JULY 14 90	5	1	1	1	1	0	15	1.17E+30	101.65					
JULY 15 90	6	430	260	250	313	1	16	3.67E+32	108.46	67	1	LOW	SW	NO

JULY 16 90	7	310	400	350	353	1	17	1.30E+35	116.26	68	3	LOW	SW	NO
JULY 17 90	8	1	1	1	1	0	16	3.89E+33	125.71					
JULY 18 90	9	20	50	10	27	1	16	2.66E+31	92.05	70	1.5	HIGH	NW	NO
JULY 19 90	10	30	10	20	20	1	16	1.48E+30	76.84	72	1.8	MED	N	NO
JULY 20 90	11	1	1	1	1	0	16	1.48E+30	76.84	72				
JULY 21 90	12	1	1	1	1	0	16	1.48E+30	76.84					
JULY 22 90	13	170	590	60	243	1	16	3.08E+30	80.45	72	1	LOW	NW	YES
JULY 23 90	14	140	220	170	177	1	17	5.44E+32	84.26	71	1.5	LOW	NW	NO
JULY 24 90	15	30	10	20	20	1	17	1.92E+31	69.22	73	1	LOW	SW	NO
JULY 25 90	16	10	40	10	20	1	17	1.36E+30	59.71	73	0.5	LOW	N	NO
JULY 26 90	17	20	10	10	13	1	17	1.25E+30	58.93	74	0	MED	NE	NO
JULY 27 90	18	1	1	1	1	0	16	3.40E+28	60.70					
JULY 28 90	19	1	1	1	1	0	15	2.04E+27	66.16					
JULY 29 90	20	360	200	80	213	1	16	4.35E+29	71.19	80	0.5	MED	NW	NO
JULY 30 90	21	1600	1200	340	1047	1	17	4.55E+32	83.38	74	0.5	LOW	SW	NO
JULY 31 90	22	390	390	340	373	1	17	2.55E+33	92.27	72	3.5	ZERO	NW	NO
AUG 01 90	23	10	10	70	30	1	17	2.55E+33	92.27	71	1	ZERO	NE	NO
AUG 02 90	24	10	70	20	33	1	18	8.50E+34	87.20	76	0.5	MED	NW	NO
AUG 03 90	25	20	10	80	37	1	19	3.12E+36	83.31	73	0	LOW	NW	NO
AUG 04 90	26	1	1	1	1	0	18	1.17E+35	88.76					
AUG 05 90	27	500	600	1000	700	1	19	8.18E+37	98.95	70	2	LOW	SW	NO
AUG 06 90	28	1000	1000	640	880	1	20	7.20E+40	110.37	70	2.5	LOW	NW	NO
AUG 07 90	29	1	1	1	1	0	19	9.81E+38	112.77					
AUG 08 90	30	30	10	10	17	1	19	2.12E+37	92.17	73	1	LOW	NW	NO
AUG 09 90	31	10	70	40	40	1	20	8.50E+38	88.40	75	0.5	MED	NE	NO
AUG 10 90	32	1	1	70	70	1	20	1.19E+39	89.90	70	1	ZERO	SE	NO
AUG 11 90	33	1	1	1	1	0	20	1.19E+39	89.90					
AUG 12 90	34	10	20	20	17	1	21	1.96E+40	82.97	74	0.5	MED	SW	NO
AUG 13 90M	35	1500	470	600	1	0	21	1.96E+40	82.97	70	0.5	ZERO	N	YES
AUG 14 90	36	260	320	280	287	1	21	1.81E+40	82.62	72	1.5	LOW	NW	NO
AUG 15 90	37	1	1	1	1	0	20	5.13E+37	76.83	70	2.5	LOW	NW	YES
AUG 16 90	38	1	1	1	1	0	20	5.13E+37	76.83					
AUG 17 90	39	1	1	1	1	0	19	1.93E+36	81.23					
AUG 18 90	40	1	1	1	1	0	18	9.63E+34	87.81					
AUG 19 90	41	380	340	510	410	1	19	3.95E+37	95.22	70	2.5	LOW	NW	YES
AUG 20 90	42	60	60	30	50	1	20	1.97E+39	92.21	70	0	LOW	NW	NO
AUG 21 90	43	1	1	1	1	0	19	8.11E+36	87.61					
AUG 22 90	44	1	1	1	1	0	18	4.59E+34	94.27					
AUG 23 90	45	1	1	1	1	0	17	2.29E+33	91.71					
AUG 24 90	46	1	1	1	1	0	16	1.15E+32	100.35					
AUG 25 90	47	1	1	1	1	0	15	8.61E+30	113.43					
AUG 26 90	48	20	290	320	210	1	16	1.81E+33	119.93	78	1.8	LOW	SW	NO
AUG 27 90	49	100	120	90	103	1	17	1.87E+35	118.79	72	2.6	LOW	N	NO
AUG 28 90	50	1	1	1	1	0	15	3.75E+32	114.52					
AUG 29 90M	51	1700	1500	700	1	0	15	8.36E+29	95.82	72	2	ZERO	N	NO
AUG 30 90M	52	260	310	260	276	1	15	6.16E+29	96.55	70	1	ZERO	SE	NO
AUG 31 90	53	105	130	160	132	1	15	2.71E+30	106.88					
SEPT 1 90	54	1	1	1	1	0	14	8.14E+28	116.16					
SEPT 2 90	55	1	1	1	1	0	13	2.22E+27	126.93					
SEPT 3 90	56	1	1	1	1	0	13	2.22E+27	126.93					
SEPT 4 90	57	10	10	10	10	1	13	3.17E+25	91.55	70	0.5	ZERO	S	NO
SEPT 5 90	58	1	1	1	1	0	12	3.60E+22	75.81					
SEPT 6 90	59	1	1	1	1	0	12	3.60E+22	75.81					

SEPT 7 90	60	1	1	1	1	0	11	2.16E+21	87.00					
SEPT 8 90	61	1	1	1	1	0	10	5.41E+19	94.94					
SEPT 9 90	62	1	1	1	1	0	9	7.72E+17	97.17					
SEPT 10 90	63	1	1	1	1	0	9	7.72E+17	97.17					
SEPT 11 90	64	1	1	1	1	0	8	4.63E+16	121.13					
SEPT 12 90	65	1	1	1	1	0	8	4.63E+16	121.13					
SEPT 13 90	66	1	1	1	1	0	7	1.62E+14	107.10					
SEPT 14 90	67	1	1	1	1	0	7	1.62E+14	107.10					
SEPT 15 90	68	1	1	1	1	0	7	1.62E+14	107.10					
SEPT 16 90M	69	120	90	230	1	0	7	1.62E+14	107.10	62	4	ZERO	NW	NO
SEPT 17 90	70	1	1	1	1	0	7	1.62E+14	107.10					
SEPT 18 90	71	1	1	1	1	0	6	3.94E+11	85.63					
SEPT 19 20	72	1	1	1	1	0	5	7.89E+09	95.36					
SEPT 20 90	73	1	1	1	1	0	5	7.89E+09	95.36					
SEPT 21 90	74	1	1	1	1	0	5	7.89E+09	95.36					
SEPT 22 90	75	1	1	1	1	0	5	7.89E+09	95.36					
SEPT 23 90M	76	40	30	50	1	0	5	7.89E+09	95.36	58	5	ZERO	W	NO
SEPT 24 90	77	1	1	1	1	0	5	7.89E+09	95.36					

[redacted]ACKS 3[redacted]EGMETR[redacted]N [redacted]E 1[redacted] [redacted]pteab[redacted]1990 [redacted]

DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	1	LOW	SW	NO
MAY 29 90	4	420	150	0	190	1	2	1.90E+03	43.59	51	3	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	1.90E+03	43.59					
MAY 31 90	6	1	1	1	1	0	2	1.90E+03	43.59					
JUNE 01 90	7	1	1	1	1	0	2	1.90E+03	43.59					
JUNE 02 90	8	1	1	1	1	0	2	1.90E+03	43.59					
JUNE 03 90	9	1	1	1	1	0	2	1.90E+03	43.59					
JUNE 04 90	10	1	1	1	1	0	2	1.90E+03	43.59					
JUNE 05 90	11	30	30	20	27	1	3	5.07E+04	37.00	55	2	ZERO	S	NO
JUNE 06 90	12	1	1	1	1	0	3	5.07E+04	37.00					
JUNE 07 90	13	1	1	1	1	0	3	5.07E+04	37.00					
JUNE 08 90	14	1	1	1	1	0	3	5.07E+04	37.00					
JUNE 09 90	15	1	1	1	1	0	3	5.07E+04	37.00					
JUNE 10 90	16	40	50	20	37	1	4	1.86E+06	36.92	58	3	ZERO	SW	NO
JUNE 11 90	17	10	10	10	10	1	5	1.86E+07	28.43	58	1	LOW	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	1.86E+07	28.43					
JUNE 13 90	19	1	1	1	1	0	5	1.86E+07	28.43					
JUNE 14 90	20	1	1	1	1	0	5	1.86E+07	28.43					
JUNE 15 90	21	1	1	1	1	0	5	1.86E+07	28.43					
JUNE 16 90	22	1	1	1	1	0	5	1.86E+07	28.43					
JUNE 17 90	23	10	10	40	20	1	6	3.72E+08	26.81	60	1	LOW	S	NO
JUNE 18 90	24	1100	800	900	933	1	7	3.47E+11	44.52	59	4	LOW	SW	NO
JUNE 19 90R	25	320	480	385	1	0	7	3.47E+11	44.52					
JUNE 20 90R	26	110	130	80	1	0	7	3.47E+11	44.52					
JUNE 21 90R	27	200	250	700	1	0	7	3.47E+11	44.52					
JUNE 22 90	28	1	1	1	1	0	7	3.47E+11	44.52					
JUNE 23 90	29	1	1	1	1	0	7	3.47E+11	44.52					
JUNE 24 90	30	400	290	300	330	1	8	1.14E+14	57.19	66	4	ZERO	NW	YES
JUNE 25 90	31	50	210	60	107	1	9	1.22E+16	61.29	66	2	LOW	W	NO
JUNE 26 90	32	140	1	120	130	1	10	1.59E+18	66.08	70	1	LOW	W	NO
JUNE 27 90	33	1	1	1	1	0	9	1.59E+17	81.50					
JUNE 28 90	34	1	1	1	1	0	8	8.35E+14	73.32					
JUNE 29 90	35	1	1	1	1	0	8	8.35E+14	73.32					
JUNE 30 90	36	1	1	1	1	0	8	8.35E+14	73.32					
JULY 01 90	37	230	210	170	203	1	9	1.70E+17	82.12	70	2	LOW	NW	NO
JULY 02 90	38	10	20	10	13	1	10	2.26E+18	68.47	72	1	MED	SW	NO
JULY 03 90	39	1	1	1	1	0	10	2.26E+18	68.47					
JULY 04 90	40	1	1	1	1	0	10	2.26E+18	68.47					
JULY 05 90	41	1	1	1	1	0	9	8.49E+16	76.03					
JULY 06 90	42	1	1	1	1	0	9	8.49E+16	76.03					
JULY 07 90	43	1	1	1	1	0	9	8.49E+16	76.03					
JULY 08 90	44	340	110	130	193	1	10	1.64E+19	83.47	72	1	LOW	SW	NO
JULY 09 90	45	300	300	270	290	1	11	4.76E+21	93.48	72	1	LOW	SW	NO
JULY 10 90	46	1	1	1	1	0	10	1.30E+20	102.65					
JULY 11 90	47	1	1	1	1	0	9	1.30E+19	132.96					
JULY 12 90	48	1	1	1	1	0	9	1.30E+19	132.96					
JULY 13 90	49	1	1	1	1	0	9	1.30E+19	132.96					
JULY 14 90	50	1	1	1	1	0	9	1.30E+19	132.96					
JULY 15 90	51	700	1100	1800	1200	1	10	1.56E+22	165.68	67	1	LOW	SW	NO

JULY 16 90	52	550	1000	2400	1317	1	11	2.05E+25	200.03	68	2	LOW	SW	NO
JULY 17 90	53	150	290	320	253	1	11	2.60E+26	251.96	68	3	LOW	SW	NO
JULY 18 90	54	10	20	20	17	1	11	4.64E+24	174.75	70	1	ZERO	NW	NO
JULY 19 90	55	20	130	10	33	1	12	2.47E+26	158.29	71	1	ZERO	W	NO
JULY 20 90	56	400	920	480	600	1	13	1.48E+29	175.38	70	2	MED	NW	YES
JULY 21 90	57	1	1	1	1	0	13	1.48E+29	175.33					
JULY 22 90	58	120	100	20	80	1	14	1.19E+31	165.84	72	1	LOW	NW	YES
JULY 23 90	59	160	130	220	170	1	15	2.02E+33	166.11	71	2	LOW	SW	NO
JULY 24 90	60	50	70	40	53	1	15	3.26E+32	147.08	73	1	MED	SW	NO
JULY 25 90	61	1	1	1	1	0	14	3.06E+30	150.49					
JULY 26 90	62	1	1	1	1	0	13	2.35E+28	152.20					
JULY 27 90	63	1	1	1	1	0	13	2.35E+28	152.20					
JULY 28 90	64	1	1	1	1	0	13	2.35E+28	152.20					
JULY 29 90	65	460	100	30	197	1	14	4.62E+30	153.01	80	1	MED	NW	NO
JULY 30 90	66	390	120	350	287	1	15	1.33E+33	161.49	74	1	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	14	6.52E+30	158.86					
AUG 01 90	68	1	1	1	1	0	13	4.89E+29	192.21					
AUG 02 90	69	1	1	1	1	0	13	4.89E+29	192.21					
AUG 03 90	70	1	1	1	1	0	13	4.89E+29	192.21					
AUG 04 90	71	1	1	1	1	0	13	4.89E+29	192.21					
AUG 05 90	72	400	3400	3300	2367	1	14	1.16E+33	229.97	70	2	LOW	SW	NO
AUG 06 90	73	440	330	340	370	1	15	4.28E+35	237.38	70	2	LOW	NW	NO
AUG 07 90	74	90	120	80	97	1	15	2.14E+35	226.66	72	2	LOW	SW	NO
AUG 08 90	75	240	70	90	133	1	15	9.84E+34	215.21	73	1	ZERO	NW	NO
AUG 09 90	76	20	20	10	17	1	16	1.64E+36	183.41	75	1	ZERO	NE	NO
AUG 10 90	77	10	10	10	10	1	17	1.64E+37	154.57	70	1	ZERO	SE	NO
AUG 11 90	78	1	1	1	1	0	17	1.64E+37	154.57					
AUG 12 90	79	90	50	30	57	1	18	9.29E+38	146.18	74	0	MED	SW	NO
AUG 13 90M	80	800	370	260	1	0	18	9.29E+38	146.18	70	0	ZERO	N	YES
AUG 14 90	81	60	40	70	57	1	18	4.39E+37	123.38	72	2	MED	NW	NO
AUG 15 90	82	1	1	1	1	0	17	3.33E+34	107.34					
AUG 16 90	83	1	1	1	1	0	16	1.32E+32	101.73					
AUG 17 90	84	1	1	1	1	0	15	7.90E+30	114.77					
AUG 18 90	85	1	1	1	1	0	14	1.48E+29	121.23					
AUG 19 90	86	210	170	170	183	1	14	4.53E+28	111.39	70	2	LOW	NW	YES
AUG 20 90	87	10	20	10	13	1	15	6.04E+29	96.69	70	0	LOW	NW	YES
AUG 21 90	88	1	1	1	1	0	14	7.55E+27	98.01					
AUG 22 90	89	1	1	1	1	0	13	4.44E+25	93.95					
AUG 23 90	90	1	1	1	1	0	12	8.33E+23	98.49					
AUG 24 90	91	1	1	1	1	0	12	8.33E+23	98.49					
AUG 25 90	92	1	1	1	1	0	12	8.33E+23	98.49					
AUG 26 90	93	100	70	85	85	1	13	7.08E+25	97.38	78	1	MED	SW	NO
AUG 27 90	94	220	520	560	433	1	14	3.07E+28	108.33	72	2	LOW	W	NO
AUG 28 90	95	1	1	1	1	0	13	1.56E+26	103.48					
AUG 29 90M	96	1200	500	600	1	0	12	5.44E+23	95.05	72	3	ZERO	N	NO
AUG 30 90	97	180	100	50	110	1	13	5.98E+25	96.13	70	1	MED	SE	NO

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DATE	DAY#	W	C	E	MEAN COUNT	D/1	RCOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 25 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	0.5	LOW	SW	NO
MAY 29 90	4	250	350	280	293	1	2	2.93E+03	54.16	51	3	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	2.93E+03	54.16					
MAY 31 90	6	1	1	1	1	0	2	2.93E+03	54.16					
JUNE 01 90	7	1	1	1	1	0	2	2.93E+03	54.16					
JUNE 02 90	8	1	1	1	1	0	2	2.93E+03	54.16					
JUNE 03 90	9	1	1	1	1	0	2	2.93E+03	54.16					
JUNE 04 90	10	1	1	1	1	0	2	2.93E+03	54.16					
JUNE 05 90	11	30	20	20	23	1	3	6.84E+04	40.91	55	3	ZERO	S	NO
JUNE 06 90	12	1	1	1	1	0	3	6.84E+04	40.91					
JUNE 07 90	13	1	1	1	1	0	3	6.84E+04	40.91					
JUNE 08 90	14	1	1	1	1	0	3	6.84E+04	40.91					
JUNE 09 90	15	1	1	1	1	0	3	6.84E+04	40.91					
JUNE 10 90	16	50	50	10	37	1	4	2.51E+06	39.80	58	2	ZERO	SW	NO
JUNE 11 90	17	50	50	30	43	1	5	1.09E+08	40.48	58	1.5	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	1.09E+08	40.48					
JUNE 13 90	19	1	1	1	1	0	5	1.09E+08	40.48					
JUNE 14 90	20	1	1	1	1	0	5	1.09E+08	40.48					
JUNE 15 90	21	1	1	1	1	0	5	1.09E+08	40.48					
JUNE 16 90	22	1	1	1	1	0	5	1.09E+08	40.48					
JUNE 17 90	23	20	20	10	17	1	6	1.81E+09	34.92	60	0.5	LOW	S	NO
JUNE 18 90	24	1000	2100	340	1147	1	7	2.08E+12	57.50	59	4	ZERO	SW	NO
JUNE 19 90	25	180	110	160	150	1	8	3.12E+14	64.82	64	3	ZERO	W	NO
JUNE 20 90	26	50	20	60	43	1	9	1.35E+16	61.99	64	0.5	ZERO	SW	NO
JUNE 21 90M	27	240	200	170	1	0	9	1.35E+16	61.99	66	4	ZERO	SW	NO
JUNE 22 90	28	320	280	260	287	1	10	3.87E+18	72.24	65	0	ZERO	S	NO
JUNE 23 90	29	1	1	1	1	0	10	3.87E+18	72.24					
JUNE 24 90	30	300	600	500	467	1	11	1.81E+21	85.60	66	4	ZERO	NW	YES
JUNE 25 90	31	40	80	40	53	1	12	9.64E+22	82.29	66	3	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	12	9.64E+22	82.29					
JUNE 27 90	33	1	1	1	1	0	11	9.64E+21	99.67					
JUNE 28 90	34	1	1	1	1	0	10	3.29E+19	89.47					
JUNE 29 90	35	1	1	1	1	0	10	3.29E+19	89.47					
JUNE 30 90	36	1	1	1	1	0	10	3.29E+19	89.47					
JULY 1 90	37	100	30	20	50	1	11	1.64E+21	84.86	70	3	ZERO	NW	NO
JULY 2 90	38	10	10	10	10	1	12	1.64E+22	71.01	72	0.5	ZERO	W	NO
JULY 3 90	39	1	1	1	1	0	12	1.64E+22	71.01					
JULY 4 90	40	1	1	1	1	0	12	1.64E+22	71.01					
JULY 5 90	41	1	1	1	1	0	11	7.04E+20	78.57					
JULY 6 90	42	1	1	1	1	0	11	7.04E+20	78.57					
JULY 7 90	43	1	1	1	1	0	11	7.04E+20	78.57					
JULY 8 90	44	50	20	10	27	1	12	1.88E+22	71.80	72	0.5	LOW	SW	NO
JULY 9 90	45	100	190	180	157	1	13	2.94E+24	76.24	72	1.5	ZERO	SW	YES
JULY 10 90	46	1	1	1	1	0	12	8.02E+22	81.04					
JULY 11 90	47	1	1	1	1	0	11	1.85E+21	85.78					
JULY 12 90	48	1	1	1	1	0	11	1.85E+21	85.78					
JULY 13 90	49	1	1	1	1	0	11	1.85E+21	85.78					
JULY 14 90	50	1	1	1	1	0	11	1.85E+21	85.78					
JULY 15 90	51	10	10	10	10	1	12	1.85E+22	71.72	61	1	ZERO	SW	NO

JULY 16 90	52	510	440	460	470	1	13	8.70E+24	82.88	68	3	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	12	5.22E+23	94.73					
JULY 18 90	54	1	1	1	1	0	11	4.55E+20	75.51					
JULY 19 90	55	1	1	1	1	0	10	3.04E+18	70.51					
JULY 20 90	56	1	1	1	1	0	9	7.00E+16	74.42					
JULY 21 90	57	1	1	1	1	0	9	7.00E+16	74.42					
JULY 22 90	58	10	40	50	33	1	9	8.15E+15	58.60	72	0.5	ZERO	NW	YES
JULY 23 90	59	150	120	180	150	1	10	1.22E+18	64.37	71	2	ZERO	SW	NO
JULY 24 90	60	80	50	60	63	1	10	1.66E+17	52.72	73	0	ZERO	SW	YES
JULY 25 90	61	1	1	1	1	0	9	3.11E+15	52.65					
JULY 26 90	62	1	1	1	1	0	9	3.11E+15	52.65					
JULY 27 90	63	1	1	1	1	0	9	3.11E+15	52.65					
JULY 28 90	64	1	1	1	1	0	9	3.11E+15	52.65					
JULY 29 90	65	110	20	20	50	1	10	1.55E+17	52.38	80	0.5	MED	NW	NO
JULY 30 90	66	220	70	30	107	1	11	1.66E+19	55.88	74	1	ZERO	SW	NO
JULY 31 90	67	1	1	1	1	0	10	3.32E+17	56.50					
AUG 1 90	68	1	1	1	1	0	9	3.32E+16	68.49					
AUG 2 90	69	1	1	1	1	0	9	3.32E+16	68.49					
AUG 3 90	70	1	1	1	1	0	9	3.32E+16	68.49					
AUG 4 90	71	1	1	1	1	0	9	3.32E+16	68.49					
AUG 5 90	72	170	190	100	153	1	10	5.08E+18	74.24	70	2	ZERO	SW	NO
AUG 6 90	73	220	270	210	233	1	11	1.19E+21	82.38	70	2	ZERO	SW	NO
AUG 7 90	74	1	1	1	1	0	10	4.45E+19	92.22					
AUG 8 90	75	1	1	1	1	0	9	2.84E+17	86.95					
AUG 9 90	76	1	1	1	1	0	9	2.84E+17	86.95					
AUG 10 90	77	1	1	1	1	0	9	2.84E+17	86.95					
AUG 11 90	78	1	1	1	1	0	9	2.84E+17	86.95					
AUG 12 90	79	20	20	40	27	1	10	7.57E+18	77.26	74	1	LOW	SW	NO
AUG 13 90M	80	200	190	180	1	0	10	7.57E+18	77.26	70	0.5	ZERO	N	YES
AUG 14 90	81	140	90	110	113	1	10	8.58E+19	98.48	72	1.5	ZERO	NW	NO
AUG 15 90	82	1	1	1	1	0	9	1.83E+17	82.78					
AUG 16 90	83	1	1	1	1	0	9	1.83E+17	82.78					
AUG 17 90	84	1	1	1	1	0	9	1.83E+17	82.78					
AUG 18 90	85	1	1	1	1	0	9	1.83E+17	82.78					
AUG 19 90	86	240	220	220	227	1	10	4.14E+19	91.56	70	2	ZERO	NW	YES
AUG 20 90	87	10	10	20	13	1	11	5.52E+20	76.85	70	0	LOW	NW	NO
AUG 21 90	88	1	1	1	1	0	10	1.66E+19	83.54					
AUG 22 90	89	1	1	1	1	0	9	1.10E+17	78.28					
AUG 23 90	90	1	1	1	1	0	8	1.74E+15	80.38					
AUG 24 90	91	1	1	1	1	0	8	1.74E+15	80.38					
AUG 25 90	92	1	1	1	1	0	8	1.74E+15	80.38					
AUG 26 90	93	40	100	50	63	1	9	1.10E+17	78.28	75	1	LOW	SW	NO
AUG 27 90	94	270	180	210	220	1	10	2.43E+19	86.80	72	2	LOW	W	NO

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DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1	ERR					
MAY 27 90	2	1	1	1	1	0	0	1.00E+00	ERR					
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	1	LOW	SW	NO
MAY 29 90	4	50	120	90	87	1	2	8.67E+02	29.44	51	3	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	8.67E+02	29.44					
MAY 31 90	6	1	1	1	1	0	2	8.67E+02	29.44					
JUNE 01 90	7	1	1	1	1	0	2	8.67E+02	29.44					
JUNE 02 90	8	1	1	1	1	0	2	8.67E+02	29.44					
JUNE 03 90	9	1	1	1	1	0	2	8.67E+02	29.44					
JUNE 04 90	10	1	1	1	1	0	2	8.67E+02	29.44					
JUNE 05 90	11	30	10	10	17	1	3	1.44E+04	24.35	55	3	ZERO	S	NO
JUNE 06 90	12	1	1	1	1	0	3	1.44E+04	24.35					
JUNE 07 90	13	1	1	1	1	0	3	1.44E+04	24.35					
JUNE 08 90	14	1	1	1	1	0	3	1.44E+04	24.35					
JUNE 09 90	15	1	1	1	1	0	3	1.44E+04	24.35					
JUNE 10 90	16	30	10	30	23	1	4	3.37E+05	24.09	58	3	LOW	SW	NO
JUNE 11 90	17	10	50	10	23	1	5	7.86E+06	23.94	58	2	LOW	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	7.86E+06	23.94					
JUNE 13 90	19	1	1	1	1	0	5	7.86E+06	23.94					
JUNE 14 90	20	1	1	1	1	0	5	7.86E+06	23.94					
JUNE 15 90	21	1	1	1	1	0	5	7.86E+06	23.94					
JUNE 16 90	22	1	1	1	1	0	5	7.86E+06	23.94					
JUNE 17 90	23	10	10	10	10	1	6	7.86E+07	20.70	60	0.5	MED	S	NO
JUNE 18 90	24	210	270	220	233	1	7	1.83E+10	29.26	59	4	LOW	SW	NO
JUNE 19 90	25	1	1	1	1	0	7	1.83E+10	29.26					
JUNE 20 90	26	1	1	1	1	0	7	1.83E+10	29.26					
JUNE 21 90	27	1	1	1	1	0	7	1.83E+10	29.26					
JUNE 22 90	28	1	1	1	1	0	7	1.83E+10	29.26					
JUNE 23 90	29	1	1	1	1	0	7	1.83E+10	29.26					
JUNE 24 90	30	100	200	100	133	1	8	2.45E+12	35.36	66	4	ZERO	NW	NO
JUNE 25 90	31	70	50	50	57	1	9	1.39E+14	37.27	66	4	LOW	W	NO
JUNE 26 90	32	1	1	1	1	0	9	1.39E+14	37.27					
JUNE 27 90	33	1	1	1	1	0	8	1.39E+13	43.93					
JUNE 28 90	34	1	1	1	1	0	7	1.60E+11	39.86					
JUNE 29 90	35	1	1	1	1	0	7	1.60E+11	39.86					
JUNE 30 90	36	1	1	1	1	0	7	1.60E+11	39.86					
JULY 1 90	37	30	10	40	27	1	8	4.27E+12	37.91	70	3	LOW	NW	NO
JULY 2 90	38	50	10	10	23	1	9	9.95E+13	35.92	72	1	MED	SW	NO
JULY 3 90	39	1	1	1	1	0	9	9.95E+13	35.92					
JULY 4 90	40	1	1	1	1	0	9	9.95E+13	35.92					
JULY 5 90	41	1	1	1	1	0	8	5.97E+12	39.54					
JULY 6 90	42	1	1	1	1	0	8	5.97E+12	39.54					
JULY 7 90	43	1	1	1	1	0	8	5.97E+12	39.54					
JULY 8 90	44	360	80	60	167	1	9	9.95E+14	46.39	72	0.5	MED	SW	NO
JULY 9 90	45	80	150	50	103	1	10	1.03E+17	50.26	72	1.5	LOW	SW	YES
JULY 10 90	46	1	1	1	1	0	9	4.41E+15	54.73					
JULY 11 90	47	1	1	1	1	0	8	1.89E+14	60.89					
JULY 12 90	48	1	1	1	1	0	8	1.89E+14	60.89					
JULY 13 90	49	1	1	1	1	0	8	1.89E+14	60.89					
JULY 14 90	50	1	1	1	1	0	8	1.89E+14	60.89					
JULY 15 90	51	30	230	60	107	1	9	2.02E+16	64.60	67	1	LOW	SW	NO

JULY 16 90	52	30	210	110	117	1	10	2.35E+18	68.73	68	3	MED	SW	NO
JULY 17 90	53	1	1	1	1	0	9	2.35E+17	85.14					
JULY 18 90	54	1	1	1	1	0	8	1.01E+15	75.06					
JULY 19 90	55	1	1	1	1	0	8	1.01E+15	75.06					
JULY 20 90	56	1	1	1	1	0	8	1.01E+15	75.06					
JULY 21 90	57	1	1	1	1	0	8	1.01E+15	75.06					
JULY 22 90	58	1300	1700	1100	1367	1	9	1.38E+18	103.62	72	0.5	LOW	NW	YES
JULY 23 90	59	120	140	150	137	1	10	1.88E+20	106.53	71	2	* ZERO	SW	NO
JULY 24 90	60	30	60	90	60	1	10	8.47E+19	98.35	73	1	MED	SW	YES
JULY 25 90	61	70	20	10	33	1	10	4.98E+19	93.27	73	0	LOW	NW	NO
JULY 26 90	62	10	80	30	40	1	11	1.99E+21	86.36	70	CALM	LOW	NW	NO
JULY 27 90	63	1	1	1	1	0	11	1.99E+21	86.36					
JULY 28 90	64	1	1	1	1	0	11	1.99E+21	86.36					
JULY 29 90	65	140	70	430	213	1	12	4.25E+23	93.12	82	0.5	HIGH	NW	NO
JULY 30 90	66	470	400	300	390	1	13	1.66E+26	103.97	74	1	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	12	6.22E+24	116.45					
AUG 1 90	68	1	1	1	1	0	11	2.66E+23	134.77					
AUG 2 90	69	1	1	1	1	0	11	2.66E+23	134.77					
AUG 3 90	70	1	1	1	1	0	11	2.66E+23	134.77					
AUG 4 90	71	1	1	1	1	0	11	2.66E+23	134.77					
AUG 5 90	72	100	150	200	150	1	12	4.00E+25	135.98	70	2.5	LOW	SW	NO
AUG 6 90	73	430	400	390	407	1	13	1.63E+28	147.94	70	3	LOW	NW	NO
AUG 7 90	74	1	1	1	1	0	12	9.75E+25	146.47					
AUG 8 90	75	1	1	1	1	0	11	9.44E+23	151.19					
AUG 9 90	76	1	1	1	1	0	11	9.44E+23	151.19					
AUG 10 90	77	1	1	1	1	0	11	9.44E+23	151.19					
AUG 11 90	78	1	1	1	1	0	11	9.44E+23	151.19					
AUG 12 90	79	30	50	10	30	1	12	2.83E+25	132.13	74	0.5	HIGH	SW	NO
AUG 13 90M	80	800	560	440	1	0	12	2.83E+25	132.13					
AUG 14 90	81	120	170	170	153	1	12	4.07E+25	136.19	72	1.7	MED	NW	NO
AUG 15 90	82	1	1	1	1	0	11	3.49E+23	138.11					
AUG 16 90	83	1	1	1	1	0	11	3.49E+23	138.11					
AUG 17 90	84	1	1	1	1	0	11	3.49E+23	138.11					
AUG 18 90	85	1	1	1	1	0	11	3.49E+23	138.11					
AUG 19 90	86	540	520	480	513	1	12	1.79E+26	154.08	70	3	LOW	NW	YES
AUG 20 90	87	120	69	20	67	1	13	1.19E+28	144.47	70	1	LOW	NW	NO
AUG 21 90	88	1	1	1	1	0	12	8.74E+24	119.80					
AUG 22 90	89	1	1	1	1	0	11	6.39E+22	118.37					
AUG 23 90	90	1	1	1	1	0	10	1.07E+21	126.69					
AUG 24 90	91	1	1	1	1	0	9	3.20E+19	146.95					
AUG 25 90	92	1	1	1	1	0	8	7.99E+17	172.91					
AUG 26 90	93	210	230	300	247	1	9	1.97E+20	179.87	78	1.3	HIGH	SW	NO
AUG 27 90	94	190	150	450	263	1	10	5.19E+22	186.96	72	2.8	MED	W	NO
AUG 28 90	95	1	1	1	1	0	9	2.43E+20	184.13					
AUG 29 90	96	1	1	1	1	0	8	6.24E+17	167.64					
AUG 30 90	97	1	1	1	1	0	8	6.24E+17	167.64					
AUG 31 90	98	1	1	1	1	0	8	6.24E+17	167.64					
SEPT 1 90	99	1	1	1	1	0	8	6.24E+17	167.64					
SEPT 2 90	100	1	1	1	1	0	8	6.24E+17	167.64					
SEPT 3 90	101	1	1	1	1	0	8	6.24E+17	167.64					
SEPT 4 90	102	20	10	10	13	1	8	5.54E+16	123.87	70	1	ZERO	S	NO
SEPT 5 90	103	1	1	1	1	0	7	1.36E+14	104.53					
SEPT 6 90	104	1	1	1	1	0	7	1.36E+14	104.53					

SEPT 7 90	105	1	1	1	1	0	7	1.36E+14	104.53					
SEPT 8 90	106	1	1	1	1	0	7	1.36E+14	104.53					
SEPT 9 90	107	1	1	1	1	0	7	1.36E+14	104.53					
SEPT 10 90	108	1	1	1	1	0	7	1.36E+14	104.53					
SEPT 11 90	109	1	1	1	1	0	6	4.54E+12	128.70					
SEPT 12 90	110	1	1	1	1	0	6	4.54E+12	128.70					
SEPT 13 90	111	1	1	1	1	0	5	2.96E+10	124.27					
SEPT 14 90	112	1	1	1	1	0	5	2.96E+10	124.27					
SEPT 15 90	113	1	1	1	1	0	5	2.96E+10	124.27					
SEPT 16 90M	114	170	390	300	1	0	5	2.96E+10	124.27	62	4	ZERO	NW	NO
SEPT 17 90	115	1	1	1	1	0	5	2.96E+10	124.27					
SEPT 18 90	116	1	1	1	1	0	4	5.77E+07	87.17					
SEPT 19 20	117	1	1	1	1	0	3	8.66E+05	95.32					
SEPT 20 90	118	1	1	1	1	0	3	8.66E+05	95.32					
SEPT 21 90	119	1	1	1	1	0	3	8.66E+05	95.32					
SEPT 22 90	120	1	1	1	1	0	3	8.66E+05	95.32					
SEPT 23 90M	121	210	130	130	1	0	3	8.66E+05	95.32	58	5	ZERO	W	NO
SEPT 24 90	122	1	1	1	1	0	3	8.66E+05	95.32					

DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	1	LOW	SW	NO
MAY 29 90	4	150	200	180	177	1	2	1.77E+03	42.03	51	5	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	1.77E+03	42.03					
MAY 31 90	6	1	1	1	1	0	2	1.77E+03	42.03					
JUNE 01 90	7	1	1	1	1	0	2	1.77E+03	42.03					
JUNE 02 90	8	1	1	1	1	0	2	1.77E+03	42.03					
JUNE 03 90	9	1	1	1	1	0	2	1.77E+03	42.03					
JUNE 04 90	10	1	1	1	1	0	2	1.77E+03	42.03					
JUNE 05 90	11	20	10	10	13	1	3	2.36E+04	28.67	55	3	ZERO	S	NO
JUNE 06 90	12	1	1	1	1	0	3	2.36E+04	28.67					
JUNE 07 90	13	1	1	1	1	0	3	2.36E+04	28.67					
JUNE 08 90	14	1	1	1	1	0	3	2.36E+04	28.67					
JUNE 09 90	15	1	1	1	1	0	3	2.36E+04	28.67					
JUNE 10 90	16	30	50	40	40	1	4	9.42E+05	31.16	58	3	ZERO	SW	NO
JUNE 11 90	17	20	20	40	27	1	5	2.51E+07	30.20	58	2	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	2.51E+07	30.20					
JUNE 13 90	19	1	1	1	1	0	5	2.51E+07	30.20					
JUNE 14 90	20	1	1	1	1	0	5	2.51E+07	30.20					
JUNE 15 90	21	1	1	1	1	0	5	2.51E+07	30.20					
JUNE 16 90	22	1	1	1	1	0	5	2.51E+07	30.20					
JUNE 17 90	23	20	10	10	13	1	6	3.35E+08	26.33	60	0.5	LOW	S	NO
JUNE 18 90	24	220	110	140	157	1	7	5.25E+10	34.00	59	3	ZERO	SW	NO
JUNE 19 90	25	1	1	1	1	0	7	5.25E+10	34.00					
JUNE 20 90	26	1	1	1	1	0	7	5.25E+10	34.00					
JUNE 21 90	27	1	1	1	1	0	7	5.25E+10	34.00					
JUNE 22 90	28	1	1	1	1	0	7	5.25E+10	34.00					
JUNE 23 90	29	1	1	1	1	0	7	5.25E+10	34.00					
JUNE 24 90	30	400	400	230	343	1	8	1.80E+13	45.39	66	4	ZERO	NW	NO
JUNE 25 90	31	20	30	10	20	1	9	3.60E+14	41.44	66	3	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	9	3.60E+14	41.44					
JUNE 27 90	33	1	1	1	1	0	8	3.60E+13	49.50					
JUNE 28 90	34	1	1	1	1	0	7	2.04E+11	41.27					
JUNE 29 90	35	1	1	1	1	0	7	2.04E+11	41.27					
JUNE 30 90	36	1	1	1	1	0	7	2.04E+11	41.27					
JULY 1 90	37	80	50	20	50	1	8	1.02E+13	42.27	70	3	LOW	NW	NO
JULY 2 90	38	10	10	10	10	1	9	1.02E+14	36.02	72	0.5	LOW	SW	NO
JULY 3 90	39	1	1	1	1	0	9	1.02E+14	36.02					
JULY 4 90	40	1	1	1	1	0	9	1.02E+14	36.02					
JULY 5 90	41	1	1	1	1	0	8	7.65E+12	40.78					
JULY 6 90	42	1	1	1	1	0	8	7.65E+12	40.78					
JULY 7 90	43	1	1	1	1	0	8	7.65E+12	40.78					
JULY 8 90	44	40	10	40	30	1	9	2.29E+14	39.41	72	1	MED	SW	NO
JULY 9 90	45	100	100	120	107	1	10	2.45E+16	43.54	72		ZERO	SW	YES
JULY 10 90	46	1	1	1	1	0	9	6.12E+14	43.93					
JULY 11 90	47	1	1	1	1	0	8	2.29E+13	46.78					
JULY 12 90	48	1	1	1	1	0	8	2.29E+13	46.78					
JULY 13 90	49	1	1	1	1	0	8	2.29E+13	46.78					
JULY 14 90	50	1	1	1	1	0	8	2.29E+13	46.78					
JULY 15 90	51	70	90	120	93	1	9	2.14E+15	50.52	67	1	LOW	SW	NO

JULY 16 90	52	320	270	250	280	1	10	6.00E+17	59.95	68	3.5	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	9	4.50E+16	70.85					
JULY 18 90	54	1	1	1	1	0	8	2.87E+14	64.16					
JULY 19 90	55	1	1	1	1	0	8	2.87E+14	64.16					
JULY 20 90	56	1	1	1	1	0	8	2.87E+14	64.16					
JULY 21 90	57	1	1	1	1	0	8	2.87E+14	64.16					
JULY 22 90	58	60	180	170	137	1	9	3.92E+16	69.78	72	1	ZERO	NE	YES
JULY 23 90	59	150	150	120	140	1	10	5.49E+18	74.81	71	2	ZERO	SW	NO
JULY 24 90	60	50	80	50	60	1	10	9.60E+17	62.84	73	1	LOW	SW	NO
JULY 25 90	61	1	1	1	1	0	9	4.80E+16	71.36					
JULY 26 90	62	1	1	1	1	0	9	4.80E+16	71.36					
JULY 27 90	63	1	1	1	1	0	9	4.80E+16	71.36					
JULY 28 90	64	1	1	1	1	0	9	4.80E+16	71.36					
JULY 29 90	65	40	80	370	163	1	10	7.84E+18	77.52	82	0.5	MED	NW	NO
JULY 30 90	66	2800	2400	1500	2233	1	11	1.75E+22	105.22	74	1	LOW	SW	NO
JULY 31 90	67	90	130	150	123	1	11	4.32E+22	114.23	72	3.2	ZERO	NW	NO
AUG 1 90	68	10	10	10	10	1	11	4.32E+22	114.23	70	1.8	ZERO	NE	NO
AUG 2 90	69	10	10	10	10	1	12	4.32E+23	93.24	74	0.5	LOW	NW	NO
AUG 3 90	70	30	10	20	20	1	13	8.64E+24	82.83	72	0	LOW	NW	NO
AUG 4 90	71	1	1	1	1	0	13	8.64E+24	82.83					
AUG 5 90	72	390	620	540	517	1	14	4.46E+27	94.40	70	2.5	LOW	SW	NO
AUG 6 90	73	570	500	550	540	1	15	2.41E+30	106.04	70	3	ZERO	NW	NO
AUG 7 90	74	1	1	1	1	0	14	8.03E+28	116.05					
AUG 8 90	75	1	1	1	1	0	13	7.53E+26	116.80					
AUG 9 90	76	1	1	1	1	0	13	7.53E+26	116.80					
AUG 10 90	77	1	1	1	1	0	13	7.53E+26	116.80					
AUG 11 90	78	1	1	1	1	0	13	7.53E+26	116.80					
AUG 12 90	79	20	10	70	33	1	14	2.51E+28	106.80	74	0.5	LOW	SW	NO
AUG 13 90R	80	1200	900	600	1	0	14	2.51E+28	106.80	70	1	ZERO	N	NO
AUG 14 90	81	80	60	50	63	1	14	1.70E+28	103.88	72	1.5	ZERO	NW	NO
AUG 15 90	82	1	1	1	1	0	13	6.08E+25	96.25					
AUG 16 90	83	1	1	1	1	0	13	6.08E+25	96.25					
AUG 17 90	84	520	800	0	660	1	14	4.02E+28	110.44	70	3	LOW	NW	YES
AUG 18 90	85	1	1	1	1	0	14	4.02E+28	110.44					
AUG 19 90	86	1	1	1	1	0	14	4.02E+28	110.44					
AUG 20 90	87	40	120	60	73	1	15	2.94E+30	107.47	70	0.5	ZERO	NW	NO
AUG 21 90	88	1	1	1	1	0	14	2.15E+28	105.64					
AUG 22 90	89	1	1	1	1	0	13	1.54E+26	103.37					
AUG 23 90	90	1	1	1	1	0	12	2.57E+24	108.17					
AUG 24 90	91	1	1	1	1	0	12	2.57E+24	108.17					
AUG 25 90	92	1	1	1	1	0	12	2.57E+24	108.17					
AUG 26 90	93	230	330	200	253	1	13	6.50E+26	115.48	78	2	HIGH	SW	NO
AUG 27 90	94	700	1400	520	873	1	14	5.68E+29	133.44	72	2.5	LOW	W	NO
AUG 28 90	95	1	1	1	1	0	13	3.47E+27	131.38					
AUG 29 90	96	1	1	1	1	0	12	1.56E+24	103.75					
AUG 30 90	97	1	1	1	1	0	11	1.26E+22	102.13					
AUG 31 90	98	1	1	1	1	0	10	1.26E+21	128.85					
SEPT 1 90	99	1	1	1	1	0	9	1.26E+20	171.17					
SEPT 2 90	100	1	1	1	1	0	8	6.31E+18	223.86					
SEPT 3 90	101	1	1	1	1	0	8	6.31E+18	223.86					
SEPT 4 90	102	10	10	10	10	1	8	1.22E+17	136.72	70	0.5	ZERO	SW	NO

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DATE	DAY#	W	C	E	MEAN COUNT	O/I	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1	ERR					
MAY 27 90	2	1	1	1	1	0	0	1.00E+00	ERR					
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	1	LOW	SW	NO
MAY 29 90	4	210	180	200	197	1	2	1.97E+03	44.35	51	5	ZERO	NE	YES
MAY 30 90	5	20	10	10	13	1	3	2.62E+04	29.71	52	2	ZERO	NE	NO
MAY 31 90	6	20	20	40	27	1	4	6.99E+05	28.92	56	1	ZERO	W	NO
JUNE 01 90	7	1	1	1	1	0	4	6.99E+05	28.92					
JUNE 02 90	8	1	1	1	1	0	4	6.99E+05	28.92					
JUNE 03 90	9	1	1	1	1	0	4	6.99E+05	28.92					
JUNE 04 90	10	1	1	1	1	0	4	6.99E+05	28.92					
JUNE 05 90	11	50	30	10	30	1	5	2.10E+07	29.13	55	3	ZERO	S	NO
JUNE 06 90	12	10	40	10	20	1	6	4.20E+08	27.36	58	1.5	ZERO	SW	NO
JUNE 07 90	13	10	10	20	13	1	7	5.59E+09	24.69	62	0.5	ZERO	NW	NO
JUNE 08 90	14	1	1	1	1	0	7	5.59E+09	24.69					
JUNE 09 90	15	1	1	1	1	0	7	5.59E+09	24.69					
JUNE 10 90	16	20	10	30	20	1	8	1.12E+11	24.05	58	2	LOW	SW	NO
JUNE 11 90	17	80	60	100	80	1	9	8.95E+12	27.48	58	2	ZERO	NW	NO
JUNE 12 90	18	1	1		1		9	8.95E+12	27.48					
JUNE 13 90	19	20	10	10	13	1	10	1.19E+14	25.57	63	1	LOW	W	NO
JUNE 14 90	20	340	300	230	290	1	11	3.46E+16	31.88	58	2.5	LOW	SW	NO
JUNE 15 90	21	1	1	1	1	0	11	3.46E+16	31.88					
JUNE 16 90	22	1	1	1	1	0	11	3.46E+16	31.88					
JUNE 17 90	23	20	10	10	13	1	12	4.61E+17	29.65	60	0.5	LOW	S	NO
JUNE 18 90	24	250	170	300	240	1	13	1.11E+20	34.82	59	4.5	ZERO	SW	NO
JUNE 19 90	25	1	1	1	1	0	13	1.11E+20	34.82					
JUNE 20 90	26	1	1	1	1	0	13	1.11E+20	34.82					
JUNE 21 90	27	1	1	1	1	0	13	1.11E+20	34.82					
JUNE 22 90	28	1	1	1	1	0	13	1.11E+20	34.82					
JUNE 23 90	29	1	1	1	1	0	13	1.11E+20	34.82					
JUNE 24 90	30	190	170	300	220	1	14	2.44E+22	39.72	66	4	ZERO	NW	NO
JUNE 25 90	31	30	10	30	23	1	15	5.69E+23	38.34	66	2	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	15	5.69E+23	38.34					
JUNE 27 90	33	30	20	20	23	1	15	1.33E+24	40.57	66	2	LOW	SW	NO
JUNE 28 90	34	120	90	140	117	1	15	7.87E+23	39.18	68	2	LOW	NE	NO
JUNE 29 90	35	1	1	1	1	0	14	5.90E+22	42.32					
JUNE 30 90	36	1	1	1	1	0	13	2.21E+21	43.85					
JULY 1 90	37	70	120	90	93	1	14	2.07E+23	46.28	70	2	LOW	SW	NO
JULY 2 90	38	170	40	10	73	1	15	1.51E+25	47.72	72	0.5	LOW	SW	NO
JULY 03 90M	39	200	30	70	1	0	15	1.51E+25	47.72	72	2	MED	W	NO
JULY 4 90	40	1	1	1	1	0	15	1.51E+25	47.72					
JULY 5 90	41	70	40	50	53	1	15	2.69E+25	49.58	73	1	MED	NE	NO
JULY 6 90	42	1	1	1	1	0	14	1.35E+24	52.91					
JULY 7 90	43	1	1	1	1	0	13	1.01E+23	58.82					
JULY 8 90	44	10	60	10	27	1	14	2.69E+24	55.59	72	1	MED	SW	NO
JULY 9 90	45	70	110	80	87	1	15	2.33E+26	57.26	72	1	LOW	SW	YES
JULY 10 90	46	1	1	1	1	0	14	1.17E+25	61.73					
JULY 11 90	47	40	90	50	60	1	14	8.75E+24	60.48	71	0.5	LOW	W	NO
JULY 12 90	48	1	1	1	1	0	14	8.75E+24	60.48					
JULY 13 90	49	1	1	1	1	0	13	6.56E+23	67.93					
JULY 14 90	50	1	1	1	1	0	12	2.26E+21	60.20					
JULY 15 90	51	80	20	530	210	1	13	4.75E+23	66.27	67	1	ZERO	SW	NO

JULY 16 90	52	210	240	300	250	1	14	1.19E+26	72.86	68	3	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	13	8.91E+24	83.03					
JULY 18 90	54	10	10	10	10	1	13	3.71E+23	65.02	70	1.5	MED	NW	NO
JULY 19 90	55	10	10	10	10	1	14	3.71E+24	56.88	70	1	LOW	W	NO
JULY 20 90	56	1	1	1	1	0	14	3.71E+24	56.88					
JULY 21 90	57	1	1	1	1	0	14	3.71E+24	56.88					
JULY 22 90	58	420	700	1200	773	1	15	2.87E+27	67.69	72	1.5	LOW	NE	YES
JULY 23 90	59	110	150	110	123	1	16	3.54E+29	70.28	72	2	ZERO	SW	NO
JULY 24 90	60	50	90	20	53	1	16	8.59E+28	64.32	73	1	MED	SW	NO
JULY 25 90	61	10	10	20	13	1	16	4.91E+28	62.11	75	0.5	MED	N	NO
JULY 26 90	62	10	20	90	40	1	17	1.96E+30	60.52	75	0.5	MED	NE	NO
JULY 27 90	63	1	1	1	1	0	16	8.41E+28	64.24					
JULY 28 90	64	1	1	1	1	0	15	7.21E+26	61.73					
JULY 29 90	65	30	100	360	163	1	16	1.18E+29	65.60	82	0.5	MED	NW	NO
JULY 30 90	66	20	460	280	253	1	17	2.98E+31	71.03	74	0.5	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	16	3.20E+29	69.83					
AUG 1 90	68	10	10	10	10	1	16	4.36E+28	61.65	72	2	LOW	NE	NO
AUG 2 90	69	100	10	0	55	1	17	2.40E+30	61.24	74	0.5	MED	NW	NO
AUG 3 90	70	1	1	1	1	0	17	2.40E+30	61.24					
AUG 4 90	71	1	1	1	1	0	16	4.49E+28	61.77					
AUG 5 90	72	1000	560	700	753	1	17	3.39E+31	71.56	70	2.6	LOW	SW	NO
AUG 6 90	73	400	700	600	567	1	18	1.92E+34	80.28	70	3	LOW	NW	NO
AUG 7 90	74	1	1	1	1	0	17	7.20E+32	65.66					
AUG 8 90	75	190	40	80	103	1	17	8.38E+32	86.53	71	1	MED	NW	NO
AUG 9 90	76	40	100	10	50	1	18	4.29E+34	83.95	74	0.5	MED	NE	NO
AUG 10 90	77	1	1	1	1	0	17	7.15E+32	85.63					
AUG 11 90	78	1	1	1	1	0	17	7.15E+32	85.63					
AUG 12 90	79	10	20	40	23	1	18	1.67E+34	79.66	74	0.5	MED	SW	NO
AUG 13 90M	80	1200	1000	700	1	0	18	1.67E+34	79.66	70	1.5	ZERO	N	YES
AUG 14 90	81	190	200	70	153	1	18	1.22E+34	73.28	72	1.5	MED	W	NO
AUG 15 90	82	1	1	1	1	0	17	4.87E+31	73.11					
AUG 16 90	83	1	1	1	1	0	17	4.87E+31	73.11					
AUG 17 90	84	1	1	1	1	0	16	4.87E+30	82.79					
AUG 18 90	85	1	1	1	1	0	15	4.87E+29	95.32					
AUG 19 90	86	1000	1000	1000	1000	1	16	4.87E+32	110.40	70	4	LOW	NW	NO
AUG 20 90	87	90	110	60	87	1	17	4.22E+34	108.84	70	0.5	LOW	NW	NO
AUG 21 90	88	70	90	180	113	1	17	6.19E+33	97.22	70	1.5	LOW	E	NO
AUG 22 90	89	10	10	20	13	1	17	6.69E+32	85.29	70	0.5	ZERO	NE	NO
AUG 23 90	90	10	10	10	10	1	17	1.25E+32	77.29	70	0.5	LOW	E	NO
AUG 24 90	91	10	230	10	83	1	17	7.84E+32	86.09	72	0.5	LOW	SE	NO
AUG 25 90	92	1	1	1	1	0	16	1.96E+31	90.32					
AUG 26 90	93	290	110	30	143	1	17	2.81E+33	92.80	76	0.5	HIGH	SW	NO
AUG 27 90	94	1000	540	400	647	1	18	1.82E+36	103.37	72	2.5	LOW	W	NO
AUG 28 90	95	1	1	1	1	0	17	1.11E+34	100.63					
AUG 29 90	96	1	1	1	1	0	16	4.39E+31	94.99					
AUG 30 90	97	1	1	1	1	0	16	4.39E+31	94.99					
AUG 31 90	98	1	1	1	1	0	15	4.39E+30	110.37					
SEPT 1 90	99	1	1	1	1	0	14	7.98E+28	115.99					
SEPT 2 90	100	1	1	1	1	0	14	7.98E+28	115.99					
SEPT 3 90	101	1	1	1	1	0	14	7.98E+28	115.99					
SEPT 4 90	102	10	10	20	13	1	14	1.41E+27	86.95	70	0.5	ZERO	SW	NO
SEPT 5 90	103	1	1	1	1	0	13	2.49E+24	75.28					
SEPT 6 90	104	1	1	1	1	0	13	2.49E+24	75.28					

SEPT 7 90	105	1	1	1	1	0	12	2.41E+22	73.32					
SEPT 8 90	106	1	1	1	1	0	11	4.83E+20	75.91					
SEPT 9 90	107	1	1	1	1	0	11	4.83E+20	75.91					
SEPT 10 90	108	1	1	1	1	0	11	4.83E+20	75.91					
SEPT 11 90	109	1	1	1	1	0	10	2.07E+19	85.42					
SEPT 12 90	110	1	1	1	1	0	10	2.07E+19	85.42					
SEPT 13 90	111	1	1	1	1	0	9	1.35E+17	80.04					
SEPT 14 90	112	1	1	1	1	0	9	1.35E+17	80.04					
SEPT 15 90	113	1	1	1	1	0	9	1.35E+17	80.04					
SEPT 16 90	114	100	160	120	1	0	9	1.35E+17	80.04	62	4	ZERO	NW	YES
SEPT 17 90	115	1	1	1	1	0	9	1.35E+17	80.04					
SEPT 18 90	116	1	1	1	1	0	8	1.35E+14	58.38					
SEPT 19 20	117	1	1	1	1	0	7	1.56E+12	55.17					
SEPT 20 90	118	1	1	1	1	0	6	1.37E+10	48.94					
SEPT 21 90	119	1	1	1	1	0	5	1.03E+09	63.47					
SEPT 22 90	120	1	1	1	1	0	4	1.03E+08	100.74					
SEPT 23 90	121	110	80	100	1	0	3	1.24E+06	107.31	58	5	LOW	W	YES
SEPT 24 90	122	1	1	1	1	0	3	1.24E+06	107.31					

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DATE	DAY#	N	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP.	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	2	LOW	SW	NO
MAY 29 90	4	80	60	50	63	1	2	6.33E+02	25.17	51	5	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	6.33E+02	25.17					
MAY 31 90	6	1	1	1	1	0	2	6.33E+02	25.17					
JUNE 01 90	7	1	1	1	1	0	2	6.33E+02	25.17					
JUNE 02 90	8	1	1	1	1	0	2	6.33E+02	25.17					
JUNE 03 90M	9	110	130	100	1	0	2	6.33E+02	25.17	50	4	ZERO	SW	NO
JUNE 04 90	10	1	1	1	1	0	2	6.33E+02	25.17					
JUNE 05 90	11	20	10	40	23	1	3	1.48E+04	24.56	55	1	LOW	S	NO
JUNE 06 90	12	1	1	1	1	0	3	1.48E+04	24.56					
JUNE 07 90	13	1	1	1	1	0	3	1.48E+04	24.56					
JUNE 08 90	14	1	1	1	1	0	3	1.48E+04	24.56					
JUNE 09 90	15	1	1	1	1	0	3	1.48E+04	24.56					
JUNE 10 90	16	20	10	20	17	1	4	2.46E+05	22.28	58	2	ZERO	SW	NO
JUNE 11 90	17	40	30	70	47	1	5	1.15E+07	25.83	58	2.5	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	1.15E+07	25.83					
JUNE 13 90	19	1	1	1	1	0	5	1.15E+07	25.83					
JUNE 14 90	20	1	1	1	1	0	5	1.15E+07	25.83					
JUNE 15 90	21	1	1	1	1	0	5	1.15E+07	25.83					
JUNE 16 90	22	1	1	1	1	0	5	1.15E+07	25.83					
JUNE 17 90	23	10	10	10	10	1	6	1.15E+08	22.05	60	0.5	LOW	S	NO
JUNE 18 90	24	350	180	210	247	1	7	2.84E+10	31.13	59	4	LOW	SW	NO
JUNE 19 90	25	1	1	1	1	0	7	2.84E+10	31.13					
JUNE 20 90	26	1	1	1	1	0	7	2.84E+10	31.13					
JUNE 21 90	27	1	1	1	1	0	7	2.84E+10	31.13					
JUNE 22 90	28	1	1	1	1	0	7	2.84E+10	31.13					
JUNE 23 90	29	1	1	1	1	0	7	2.84E+10	31.13					
JUNE 24 90	30	100	70	60	77	1	8	2.17E+12	34.85	66	4	ZERO	NW	YES
JUNE 25 90	31	80	30	40	50	1	9	1.09E+14	36.27	66	1	LOW	W	NO
JUNE 26 90	32	1	1	1	1	0	9	1.09E+14	36.27					
JUNE 27 90	33	1	1	1	1	0	8	1.09E+13	42.61					
JUNE 28 90	34	1	1	1	1	0	7	1.72E+11	40.27					
JUNE 29 90	35	1	1	1	1	0	7	1.72E+11	40.27					
JUNE 30 90	36	1	1	1	1	0	7	1.72E+11	40.27					
JULY 1 90	37	50	30	150	77	1	8	1.32E+13	43.64	65	3	LOW	NW	NO
JULY 2 90	38	10	20	90	40	1	9	5.26E+14	43.22	72	1	LOW	SW	NO
JULY 3 90	39	1	1	1	1	0	9	5.26E+14	43.22					
JULY 4 90	40	1	1	1	1	0	9	5.26E+14	43.22					
JULY 5 90	41	1	1	1	1	0	8	2.26E+13	46.68					
JULY 6 90	42	1	1	1	1	0	8	2.26E+13	46.68					
JULY 7 90	43	1	1	1	1	0	8	2.26E+13	46.68					
JULY 8 90	44	10	30	10	17	1	9	3.76E+14	41.63	72	1	LOW	SW	NO
JULY 9 90	45	40	50	40	43	1	10	1.63E+16	41.80	72	1	LOW	SW	NO
JULY 10 90	46	1	1	1	1	0	9	9.77E+14	46.30					
JULY 11 90	47	1	1	1	1	0	8	2.09E+13	46.25					
JULY 12 90	48	1	1	1	1	0	8	2.09E+13	46.25					
JULY 13 90	49	1	1	1	1	0	8	2.09E+13	46.25					
JULY 14 90	50	1	1	1	1	0	8	2.09E+13	46.25					
JULY 15 90	51	10	10	10	10	1	9	2.09E+14	39.01	67	1	LOW	SW	NO

JULY 16 90	52	160	70	80	103	1	10	2.16E+16	43.01	68	2	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	9	2.16E+15	50.57					
JULY 18 90	54	1	1	1	1	0	8	8.77E+12	41.49					
JULY 19 90	55	1	1	1	1	0	8	8.77E+12	41.49					
JULY 20 90	56	1	1	1	1	0	8	8.77E+12	41.49					
JULY 21 90	57	1	1	1	1	0	8	8.77E+12	41.49					
JULY 22 90	58	410	600	1700	903	1	9	7.93E+15	58.42	72	1.5	LOW	NW	YES
JULY 23 90	59	30	90	60	60	1	10	4.76E+17	58.58	71	2.3	ZERO	SW	NO
JULY 24 90	60	120	40	360	173	1	10	1.08E+18	63.55	73	1	LOW	SW	NO
JULY 25 90	61	1	1	1	1	0	9	2.15E+16	65.27					
JULY 26 90	62	1	1	1	1	0	9	2.15E+16	65.27					
JULY 27 90	63	1	1	1	1	0	9	2.15E+16	65.27					
JULY 28 90	64	1	1	1	1	0	9	2.15E+16	65.27					
JULY 29 90	65	80	90	140	103	1	10	2.22E+18	68.34	82	0.5	MED	W	NO
JULY 30 90	66	10	20	50	27	1	11	5.92E+19	62.74	74	0.5	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	10	7.73E+17	61.49					
AUG 1 90	68	1	1	1	1	0	9	1.93E+16	64.50					
AUG 2 90	69	1	1	1	1	0	9	1.93E+16	64.50					
AUG 3 90	70	1	1	1	1	0	9	1.93E+16	64.50					
AUG 4 90	71	1	1	1	1	0	9	1.93E+16	64.50					
AUG 5 90	72	330	290	400	340	1	10	6.57E+18	76.16	70	2	LOW	SW	NO
AUG 6 90	73	450	430	270	383	1	11	2.52E+21	88.22	70	3	LOW	NW	NO
AUG 7 90	74	1	1	1	1	0	10	1.51E+20	104.21					
AUG 8 90	75	1	1	1	1	0	9	3.49E+18	114.89					
AUG 9 90	76	1	1	1	1	0	9	3.49E+18	114.89					
AUG 10 90	77	1	1	1	1	0	9	3.49E+18	114.89					
AUG 11 90	78	1	1	1	1	0	9	3.49E+18	114.89					
AUG 12 90	79	50	60	50	53	1	10	1.86E+20	106.40	75	0.5	LOW	SW	NO
AUG 13 90	80	1000	600	860	1	0	10	1.86E+20	106.40	70	2	ZERO	NW	NO
AUG 14 90	81	60	50	100	70	1	10	1.30E+21	129.26	72	1.5	LOW	W	NO
AUG 15 90	82	1	1	1	1	0	9	1.26E+19	132.51					
AUG 16 90	83	1	1	1	1	0	9	1.26E+19	132.51					
AUG 17 90	84	1	1	1	1	0	9	1.26E+19	132.51					
AUG 18 90	85	1	1	1	1	0	9	1.26E+19	132.51					
AUG 19 90M	86	270	290	290	1	0	9	1.26E+19	132.51	70	5	ZERO	NW	NO
AUG 20 90	87	50	40	50	47	1	10	5.88E+20	119.38	70	1	LOW	NW	NO
AUG 21 90	88	1	1	1	1	0	9	6.51E+17	95.34					
AUG 22 90	89	1	1	1	1	0	8	1.08E+16	101.02					
AUG 23 90	90	1	1	1	1	0	7	6.26E+13	93.52					
AUG 24 90	91	1	1	1	1	0	7	6.26E+13	93.52					
AUG 25 90	92	1	1	1	1	0	7	6.26E+13	93.52					
AUG 26 90	93	210	30	50	97	1	8	6.05E+15	93.91	78	1.5	HIGH	SW	NO
AUG 27 90	94	50	1300	430	393	1	9	3.59E+18	115.26	72	2.5	LOW	W	NO

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DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP.	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1	ERR					
MAY 27 90	2	1	1	1	1	0	0	1.00E+00	ERR					
MAY 28 90	3	10	260	10	93	1	1	9.33E+01	93.33	52	0.5	ZERO	SW	NO
MAY 29 90	4	140	170	80	130	1	2	1.21E+04	110.15	51	5	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	1.21E+04	110.15					
MAY 31 90	6	1	1	1	1	0	2	1.21E+04	110.15					
JUNE 01 90	7	1	1	1	1	0	2	1.21E+04	110.15					
JUNE 02 90	8	1	1	1	1	0	2	1.21E+04	110.15					
JUNE 03 90	9	1	1	1	1	0	2	1.21E+04	110.15					
JUNE 04 90	10	1	1	1	1	0	2	1.21E+04	110.15					
JUNE 05 90	11	30	20	20	23	1	3	2.83E+05	65.66	55	2	ZERO	S	NO
JUNE 06 90	12	1	1	1	1	0	3	2.83E+05	65.66					
JUNE 07 90	13	1	1	1	1	0	3	2.83E+05	65.66					
JUNE 08 90	14	1	1	1	1	0	3	2.83E+05	65.66					
JUNE 09 90	15	1	1	1	1	0	3	2.83E+05	65.66					
JUNE 10 90	16	20	10	50	27	1	4	7.55E+06	52.42	58	2.5	ZERO	SW	NO
JUNE 11 90	17	60	40	20	40	1	5	3.02E+08	49.66	58	2	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	3.02E+08	49.66					
JUNE 13 90	19	1	1	1	1	0	5	3.02E+08	49.66					
JUNE 14 90	20	1	1	1	1	0	5	3.02E+08	49.66					
JUNE 15 90	21	1	1	1	1	0	5	3.02E+08	49.66					
JUNE 16 90	22	1	1	1	1	0	5	3.02E+08	49.66					
JUNE 17 90	23	20	30	20	23	1	6	7.05E+09	43.79	60	0.5	LOW	S	NO
JUNE 18 90	24	260	180	250	230	1	7	1.62E+12	55.49	59	3.5	ZERO	SW	NO
JUNE 19 90	25	1	1	1	1	0	7	1.62E+12	55.49					
JUNE 20 90	26	1	1	1	1	0	7	1.62E+12	55.49					
JUNE 21 90	27	1	1	1	1	0	7	1.62E+12	55.49					
JUNE 22 90	28	1	1	1	1	0	7	1.62E+12	55.49					
JUNE 23 90	29	1	1	1	1	0	7	1.62E+12	55.49					
JUNE 24 90	30	130	100	130	120	1	8	1.94E+14	61.11	66	4	ZERO	NW	NO
JUNE 25 90	31	30	50	20	33	1	9	6.48E+15	57.13	66	3	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	9	6.48E+15	57.13					
JUNE 27 90	33	1	1	1	1	0	8	6.95E+13	53.73					
JUNE 28 90	34	1	1	1	1	0	7	5.34E+11	47.36					
JUNE 29 90	35	1	1	1	1	0	7	5.34E+11	47.36					
JUNE 30 90	36	1	1	1	1	0	7	5.34E+11	47.36					
JULY 1 90	37	220	320	350	297	1	8	1.59E+14	59.57	70	3	ZERO	SW	NO
JULY 2 90	38	90	20	10	40	1	9	6.34E+15	56.99	72	0.5	LOW	SW	NO
JULY 3 90	39	1	1	1	1	0	9	6.34E+15	56.99					
JULY 4 90	40	1	1	1	1	0	9	6.34E+15	56.99					
JULY 5 90	41	1	1	1	1	0	8	2.72E+14	63.72					
JULY 6 90	42	1	1	1	1	0	8	2.72E+14	63.72					
JULY 7 90	43	1	1	1	1	0	8	2.72E+14	63.72					
JULY 8 90	44	10	10	10	10	1	9	2.72E+15	51.87	72	1	LOW	SW	NO
JULY 9 90	45	80	80	60	73	1	10	1.99E+17	53.70	72	1	LOW	SW	YES
JULY 10 90	46	1	1	1	1	0	9	7.47E+15	58.04					
JULY 11 90	47	1	1	1	1	0	8	1.87E+14	60.80					
JULY 12 90	48	1	1	1	1	0	8	1.87E+14	60.80					
JULY 13 90	49	1	1	1	1	0	8	1.87E+14	60.80					
JULY 14 90	50	1	1	1	1	0	8	1.87E+14	60.80					
JULY 15 90	51	40	70	10	40	1	9	7.47E+15	58.04	67	1	MED	SW	NO

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JULY 16 90	52	320	540	540	467	1	10	3.49E+18	71.49	68	2.5	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	9	1.49E+17	80.96					
JULY 18 90	54	1	1	1	1	0	8	6.50E+14	71.05					
JULY 19 90	55	1	1	1	1	0	8	6.50E+14	71.05					
JULY 20 90	56	1	1	1	1	0	8	6.50E+14	71.05					
JULY 21 90	57	1	1	1	1	0	8	6.50E+14	71.05					
JULY 22 90	58	600	560	40	400	1	9	2.60E+17	86.10	72	1.5	ZERO	NE	YES
JULY 23 90	59	110	70	90	90	1	10	2.34E+19	86.48	71	1	LOW	SW	NO
JULY 24 90	60	30	50	50	43	1	10	8.45E+18	78.10	72	1	LOW	SW	NO
JULY 25 90	61	1	1	1	1	0	9	2.53E+17	85.85					
JULY 26 90	62	1	1	1	1	0	9	2.53E+17	85.85					
JULY 27 90	63	1	1	1	1	0	9	2.53E+17	85.85					
JULY 28 90	64	1	1	1	1	0	9	2.53E+17	85.85					
JULY 29 90	65	30	90	130	83	1	10	2.11E+19	85.60	82	0.5	LOW	N	NO
JULY 30 90	66	340	70	100	170	1	11	3.59E+21	91.11	74	0.5	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	10	1.21E+19	80.96					
AUG 1 90	68	1	1	1	1	0	9	3.03E+17	87.56					
AUG 2 90	69	1	1	1	1	0	9	3.03E+17	87.56					
AUG 3 90	70	1	1	1	1	0	9	3.03E+17	87.56					
AUG 4 90	71	1	1	1	1	0	9	3.03E+17	87.56					
AUG 5 90	72	1200	540	500	747	1	10	2.26E+20	108.49	70	2.5	LOW	SW	NO
AUG 6 90	73	360	250	210	273	1	11	6.17E+22	118.00	70	3	ZERO	NW	NO
AUG 7 90	74	1	1	1	1	0	10	6.17E+21	151.03					
AUG 8 90	75	1	1	1	1	0	9	8.42E+19	163.65					
AUG 9 90	76	1	1	1	1	0	9	8.42E+19	163.65					
AUG 10 90	77	1	1	1	1	0	9	8.42E+19	163.65					
AUG 11 90	78	1	1	1	1	0	9	8.42E+19	163.65					
AUG 12 90	79	10	50	10	23	1	10	1.96E+21	134.69	74	1	MED	SW	NO
AUG 13 90R	80	520	300	240	1	0	10	1.96E+21	134.69	70	1.8	ZERO	N	YES
AUG 14 90	81	90	260	140	163	1	10	8.02E+21	155.03	72	1.2	ZERO	SW	NO
AUG 15 90	82	1	1	1	1	0	9	1.72E+19	137.17					
AUG 16 90	83	1	1	1	1	0	9	1.72E+19	137.17					
AUG 17 90	84	1	1	1	1	0	9	1.72E+19	137.17					
AUG 18 90	85	1	1	1	1	0	9	1.72E+19	137.17					
AUG 19 90R	86	700	1700	900	1	0	9	1.72E+19	137.17	70	4	ZERO	NW	NO
AUG 20 90	87	60	60	70	63	1	10	1.09E+21	126.97	70	1	LOW	NW	NO
AUG 21 90	88	50	50	50	50	1	10	1.36E+20	103.13	70	1	LOW	E	NO
AUG 22 90	89	1	1	1	1	0	9	1.51E+18	104.70					
AUG 23 90	90	1	1	1	1	0	8	3.49E+16	116.91					
AUG 24 90	91	1	1	1	1	0	8	3.49E+16	116.91					
AUG 25 90	92	1	1	1	1	0	8	3.49E+16	116.91					
AUG 26 90	93	10	40	120	57	1	9	1.98E+18	107.87	78	1	HIGH	SW	NO
AUG 27 90	94	310	340	340	330	1	10	6.53E+20	120.63	72	2	LOW	W	NO

DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP.	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1	ERR					
MAY 27 90	2	1	1	1	1	0	0	1.00E+00	ERR					
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	2	LOW	SW	NO
MAY 29 90	4	70	60	90	73	1	2	7.33E+02	27.08	51	5	ZERO	NE	YES
MAY 30 90	5	1	1	1	1	0	2	7.33E+02	27.08					
MAY 31 90	6	1	1	1	1	0	2	7.33E+02	27.08					
JUNE 01 90	7	1	1	1	1	0	2	7.33E+02	27.08					
JUNE 02 90	8	1	1	1	1	0	2	7.33E+02	27.08					
JUNE 03 90	9	1	1	1	1	0	2	7.33E+02	27.08					
JUNE 04 90	10	1	1	1	1	0	2	7.33E+02	27.08					
JUNE 05 90	11	10	20	20	17	1	3	1.22E+04	23.03	55	1.5	LOW	S	NO
JUNE 06 90	12	1	1	1	1	0	3	1.22E+04	23.03					
JUNE 07 90	13	1	1	1	1	0	3	1.22E+04	23.03					
JUNE 08 90	14	1	1	1	1	0	3	1.22E+04	23.03					
JUNE 09 90	15	1	1	1	1	0	3	1.22E+04	23.03					
JUNE 10 90	16	20	20	40	27	1	4	3.26E+05	23.89	58	1	LOW	SW	NO
JUNE 11 90	17	60	40	20	40	1	5	1.30E+07	26.49	58	2	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	5	1.30E+07	26.49					
JUNE 13 90	19	1	1	1	1	0	5	1.30E+07	26.49					
JUNE 14 90	20	1	1	1	1	0	5	1.30E+07	26.49					
JUNE 15 90	21	1	1	1	1	0	5	1.30E+07	26.49					
JUNE 16 90	22	1	1	1	1	0	5	1.30E+07	26.49					
JUNE 17 90	23	10	10	10	10	1	6	1.30E+08	22.52	60	0.5	LOW	S	NO
JUNE 18 90	24	550	300	420	423	1	7	5.52E+10	34.24	59	3	ZERO	SW	NO
JUNE 19 90	25	1	1	1	1	0	7	5.52E+10	34.24					
JUNE 20 90	26	1	1	1	1	0	7	5.52E+10	34.24					
JUNE 21 90	27	1	1	1	1	0	7	5.52E+10	34.24					
JUNE 22 90	28	1	1	1	1	0	7	5.52E+10	34.24					
JUNE 23 90	29	1	1	1	1	0	7	5.52E+10	34.24					
JUNE 24 90	30	190	140	100	143	1	8	7.91E+12	40.95	66	3	ZERO	NW	NO
JUNE 25 90	31	20	10	20	17	1	9	1.32E+14	37.06	66	2	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	9	1.32E+14	37.06					
JUNE 27 90	33	1	1	1	1	0	8	1.32E+13	43.65					
JUNE 28 90	34	1	1	1	1	0	7	1.80E+11	40.53					
JUNE 29 90	35	1	1	1	1	0	7	1.80E+11	40.53					
JUNE 30 90	36	1	1	1	1	0	7	1.80E+11	40.53					
JULY 1 90	37	70	70	70	70	1	8	1.26E+13	43.40	70	3	LOW	SW	NO
JULY 2 90	38	30	30	10	23	1	9	2.94E+14	40.51	72	0.5	LOW	SW	NO
JULY 3 90	39	1	1	1	1	0	9	2.94E+14	40.51					
JULY 4 90	40	1	1	1	1	0	9	2.94E+14	40.51					
JULY 5 90	41	1	1	1	1	0	8	1.76E+13	45.26					
JULY 6 90	42	1	1	1	1	0	8	1.76E+13	45.26					
JULY 7 90	43	1	1	1	1	0	8	1.76E+13	45.26					
JULY 8 90	44	10	10	10	10	1	9	1.76E+14	38.27	72	1	LOW	SW	NO
JULY 9 90	45	80	40	110	77	1	10	1.35E+16	41.03	72	1.5	LOW	SW	NO
JULY 10 90	46	1	1	1	1	0	9	5.07E+14	43.04					
JULY 11 90	47	1	1	1	1	0	8	1.27E+13	43.43					
JULY 12 90	48	1	1	1	1	0	8	1.27E+13	43.43					
JULY 13 90	49	1	1	1	1	0	8	1.27E+13	43.43					
JULY 14 90	50	1	1	1	1	0	8	1.27E+13	43.43					
JULY 15 90	51	20	10	10	13	1	9	1.69E+14	38.09	67	1	ZERO	SW	NO

JULY 16 90	52	170	180	220	190	1	10	3.21E+16	44.73	68	2	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	9	3.21E+15	52.83					
JULY 18 90	54	1	1	1	1	0	8	7.58E+12	40.73					
JULY 19 90	55	1	1	1	1	0	8	7.58E+12	40.73					
JULY 20 90	56	1	1	1	1	0	8	7.58E+12	40.73					
JULY 21 90	57	1	1	1	1	0	8	7.58E+12	40.73					
JULY 22 90	58	320	300	390	337	1	9	2.55E+15	51.51	72	1.5	ZERO	NW	YES
JULY 23 90	59	60	90	100	83	1	10	2.13E+17	54.05	71	2.2 *	LOW	SW	NO
JULY 24 90	60	30	50	50	43	1	10	6.43E+16	47.95	73	0.5	LOW	SW	NO
JULY 25 90	61	1	1	1	1	0	9	3.86E+15	53.93					
JULY 26 90	62	1	1	1	1	0	9	3.86E+15	53.93					
JULY 27 90	63	1	1	1	1	0	9	3.86E+15	53.93					
JULY 28 90	64	1	1	1	1	0	9	3.86E+15	53.93					
JULY 29 90	65	70	20	10	33	1	10	1.29E+17	51.39	82	0.5	MED	NW	NO
JULY 30 90	66	40	10	20	23	1	11	3.00E+18	47.83	74	0.5	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	10	4.29E+16	46.05					
AUG 1 90	68	1	1	1	1	0	9	1.84E+15	49.66					
AUG 2 90	69	1	1	1	1	0	9	1.84E+15	49.66					
AUG 3 90	70	1	1	1	1	0	9	1.84E+15	49.66					
AUG 4 90	71	1	1	1	1	0	9	1.84E+15	49.66					
AUG 5 90	72	70	220	330	207	1	10	3.80E+17	57.27	70	2	LOW	SW	NO
AUG 6 90	73	470	290	380	380	1	11	1.44E+20	68.02	70	3	ZERO	NW	NO
AUG 7 90	74	1	1	1	1	0	10	1.44E+19	82.40					
AUG 8 90	75	1	1	1	1	0	9	1.88E+17	83.06					
AUG 9 90	76	1	1	1	1	0	9	1.88E+17	83.06					
AUG 10 90	77	1	1	1	1	0	9	1.88E+17	83.06					
AUG 11 90	78	1	1	1	1	0	9	1.88E+17	83.06					
AUG 12 90	79	20	10	10	13	1	10	2.51E+18	69.17	75	1	MED	SW	NO
AUG 13 90M	80	900	590	630	1	0	10	2.51E+18	69.17	70	2	ZERO	NW	YES
AUG 14 90	81	40	110	50	67	1	10	1.25E+19	81.25	72	1.5	LOW	SW	NO
AUG 15 90	82	1	1	1	1	0	9	6.60E+16	73.93					
AUG 16 90	83	1	1	1	1	0	9	6.60E+16	73.93					
AUG 17 90	84	1	1	1	1	0	9	6.60E+16	73.93					
AUG 18 90	85	1	1	1	1	0	9	6.60E+16	73.93					
AUG 19 90M	86	370	430	260	1	0	9	6.60E+16	73.93	70	5	ZERO	NW	NO
AUG 20 90	87	110	60	40	70	1	10	4.62E+18	73.53	70	1	ZERO	NW	NO
AUG 21 90	88	1	1	1	1	0	9	1.37E+16	62.09					
AUG 22 90	89	1	1	1	1	0	8	1.65E+14	59.85					
AUG 23 90	90	1	1	1	1	0	7	3.80E+12	62.68					
AUG 24 90	91	1	1	1	1	0	7	3.80E+12	62.68					
AUG 25 90	92	1	1	1	1	0	7	3.80E+12	62.68					
AUG 26 90	93	30	10	20	20	1	8	7.60E+13	54.34	78	1	HIGH	SW	NO
AUG 27 90	94	20	30	20	23	1	9	1.77E+15	49.47	72	2	LOW	W	NO

DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP.	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	1	LOW	SW	NO
MAY 29 90	4	70	100	70	80	1	2	8.00E+02	28.28	51	5	ZERO	NE	YES
MAY 30 90	5	10	10	10	10	1	3	8.00E+03	20.00	51	2.5	ZERO	NE	NO
MAY 31 90	6	10	10	10	10	1	4	8.00E+04	16.82	54	0.5	ZERO	W	NO
JUNE 01 90	7	1	1	1	1	0	4	8.00E+04	16.82					
JUNE 02 90	8	1	1	1	1	0	4	8.00E+04	16.82					
JUNE 03 90M	9	130	50	100	1	0	4	8.00E+04	16.82	50	4	ZERO	SW	NO
JUNE 04 90	10	1	1	1	1	0	4	8.00E+04	16.82					
JUNE 05 90	11	30	30	20	27	1	5	2.13E+06	18.44	55	1.5	ZERO	S	NO
JUNE 06 90	12	10	10	10	10	1	6	2.13E+07	16.65	58	0.5	ZERO	SW	NO
JUNE 07 90	13	10	20	10	13	1	7	2.84E+08	16.13	61	0.5	ZERO	NW	NO
JUNE 08 90	14	1	1	1	1	0	7	2.84E+08	16.13					
JUNE 09 90	15	1	1	1	1	0	7	2.84E+08	16.13					
JUNE 10 90	16	30	40	20	30	1	8	8.53E+09	17.43	58	0.5	ZERO	SW	NO
JUNE 11 90	17	20	20	40	27	1	9	2.28E+11	18.28	58	2.5	ZERO	NW	NO
JUNE 12 90	18	1	1	1	1	0	9	2.28E+11	18.28					
JUNE 13 90	19	10	10	10	10	1	10	2.28E+12	17.21	62	0.5	LOW	W	NO
JUNE 14 90	20	390	490	610	497	1	11	1.13E+15	23.36	58	1	LOW	SW	NO
JUNE 15 90	21	1	1	1	1	0	11	1.13E+15	23.36					
JUNE 16 90	22	1	1	1	1	0	11	1.13E+15	23.36					
JUNE 17 90	23	10	10	10	10	1	12	1.13E+16	21.77	60	0	LOW	S	NO
JUNE 18 90	24	380	350	430	387	1	13	4.37E+18	27.16	59	2.5	ZERO	SW	NO
JUNE 19 90	25	1	1	1	1	0	13	4.37E+18	27.16					
JUNE 20 90	26	1	1	1	1	0	13	4.37E+18	27.16					
JUNE 21 90	27	1	1	1	1	0	13	4.37E+18	27.16					
JUNE 22 90	28	1	1	1	1	0	13	4.37E+18	27.16					
JUNE 23 90	29	1	1	1	1	0	13	4.37E+18	27.16					
JUNE 24 90	30	200	100	140	147	1	14	6.41E+20	30.63	66	2.5	ZERO	NW	YES
JUNE 25 90	31	45	20	85	50	1	15	3.20E+22	31.65	66	1	LOW	W	NO
JUNE 26 90	32	1	1	1	1	0	15	3.20E+22	31.65					
JUNE 27 90	33	40	10	20	23	1	15	7.48E+22	33.49	66	1	ZERO	S	NO
JUNE 28 90M	34	90	70	160	1	0	14	9.35E+20	31.47	68	4.5	ZERO	NE	NO
JUNE 29 90	35	1	1	1	1	0	13	9.35E+19	34.37					
JUNE 30 90	36	1	1	1	1	0	12	9.35E+18	38.10					
JULY 1 90	37	700	500	360	520	1	13	4.86E+21	46.58	70	3	LOW	NW	NO
JULY 2 90	38	20	20	30	23	1	14	1.13E+23	44.34	72	1	LOW	SW	NO
JULY 3 90M	39	10	10	20	1	0	14	1.13E+23	44.34	72	2	MED	W	NO
JULY 4 90	40	1	1	1	1	0	14	1.13E+23	44.34					
JULY 5 90	41	20	30	40	30	1	14	1.28E+23	44.71	74	1	MED	NE	NO
JULY 6 90	42	1	1	1	1	0	13	1.28E+22	50.17					
JULY 7 90	43	1	1	1	1	0	12	9.57E+20	56.03					
JULY 8 90	44	10	10	10	10	1	13	9.57E+21	49.07	72	0.5	MED	SW	NO
JULY 9 90	45	50	40	40	43	1	14	4.15E+23	48.64	72	0.5	LOW	SW	NO
JULY 10 90	46	1	1	1	1	0	13	1.38E+22	50.48					
JULY 11 90	47	100	120	190	137	1	13	7.08E+22	57.24	70	0.5	LOW	N	NO
JULY 12 90	48	1	1	1	1	0	13	7.08E+22	57.24					
JULY 13 90	49	1	1	1	1	0	12	7.08E+21	66.20					
JULY 14 90	50	1	1	1	1	0	11	1.43E+19	55.12					
JULY 15 90	51	10	80	10	33	1	12	4.75E+20	52.86	67	1	LOW	SW	NO

JULY 16 90	52	190	210	190	197	1	13	9.35E+22	58.48	68	2	LOW	SW	NO
JULY 17 90	53	1	1	1	1	0	12	9.35E+21	57.75					
JULY 18 90	54	10	40	10	20	1	12	4.84E+20	52.93	71	0	HIGH	NW	NO
JULY 19 90	55	10	10	20	13	1	13	6.45E+21	47.60	70	0.5	ZERO	W	NO
JULY 20 90	56	1	1	1	1	0	13	6.45E+21	47.60					
JULY 21 90	57	1	1	1	1	0	13	6.45E+21	47.60					
JULY 22 90	58	770	720	2600	745	1	14	4.60E+24	57.94	72	1	LOW	NW	YES
JULY 23 90	59	60	10	20	30	1	15	1.44E+26	55.45	71	2	ZERO	SW	NO
JULY 24 90	60	10	10	40	20	1	15	1.97E+25	48.55	73	1	LOW	SW	NO
JULY 25 90	61	40	10	50	33	1	15	1.31E+25	47.26	74	0.5	MED	W	NO
JULY 26 90	62	30	50	10	30	1	16	3.93E+26	45.94	75	0.5	MED	NE	NO
JULY 27 90	63	1	1	1	1	0	15	1.68E+25	48.06					
JULY 28 90	64	1	1	1	1	0	15	1.68E+25	48.06					
JULY 29 90	65	90	190	80	117	1	16	1.97E+27	50.80	82	0.5	MED	NW	NO
JULY 30 90	66	10	10	10	10	1	17	1.97E+28	46.17	74	0.5	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	16	3.78E+25	39.68					
AUG 1 90	68	10	10	60	27	1	16	4.32E+25	40.01	71	4	LOW	NE	NO
AUG 2 90	69	70	20	40	43	1	17	1.87E+27	40.20	74	0.5	MED	NW	NO
AUG 3 90	70	1	1	1	1	0	17	1.87E+27	40.20					
AUG 4 90	71	1	1	1	1	0	16	6.24E+25	40.94					
AUG 5 90	72	1900	2100	800	1600	1	17	9.98E+28	50.80	70	1	LOW	SW	NO
AUG 6 90	73	290	400	240	310	1	18	3.09E+31	56.17	70	3	LOW	NW	NO
AUG 7 90	74	80	50	60	63	1	18	1.96E+32	62.23	72	1.5	LOW	SW	NO
AUG 8 90	75	30	40	20	30	1	18	1.36E+32	60.97	72	0.5	ZERO	NW	NO
AUG 9 90	76	60	10	180	83	1	19	1.13E+34	61.98	71	4	LOW	NE	NO
AUG 10 90	77	1	1	1	1	0	18	8.27E+31	59.32					
AUG 11 90	78	1	1	1	1	0	18	8.27E+31	59.32					
AUG 12 90	79	20	60	360	147	1	19	1.21E+34	62.22	75	0.5	LOW	SW	NO
AUG 13 90	80	1700	1800	1500	1667	1	20	2.02E+37	73.33	70	2.5	ZERO	NW	NO
AUG 14 90	81	60	90	220	123	1	20	7.48E+37	78.29	73	1	LOW	SW	NO
AUG 15 90	82	140	200	170	170	1	20	6.47E+37	77.72	73	1.5	LOW	SW	NO
AUG 16 90	83	110	60	60	77	1	21	4.96E+39	77.67	73	1.5	LOW	SW	NO
AUG 17 90	84	40	100	70	70	1	21	1.74E+40	82.45	72	0	ZERO	W	NO
AUG 18 90	85	1	1	1	1	0	20	1.30E+39	90.31					
AUG 19 90M	86	220	120	130	1	0	20	1.30E+39	90.31	70	6	ZERO	NW	NO
AUG 20 90	87	110	20	20	50	1	21	6.51E+40	87.80	69	1.5	LOW	NW	NO
AUG 21 90	88	1	1	1	1	0	20	8.74E+37	78.90					
AUG 22 90	89	1	1	1	1	0	19	2.91E+36	83.02					
AUG 23 90	90	1	1	1	1	0	18	1.46E+35	89.85					
AUG 24 90	91	1	1	1	1	0	17	4.37E+33	95.24					
AUG 25 90	92	1	1	1	1	0	16	1.46E+32	102.38					
AUG 26 90	93	40	70	60	57	1	17	8.25E+33	98.28	78	1	HIGH	SW	NO
AUG 27 90	94	440	700	470	537	1	18	4.43E+36	108.62	72	2.2	LOW	W	NO
AUG 28 90	95	1	1	1	1	0	17	3.80E+34	108.16					
AUG 29 90	96	1	1	1	1	0	16	3.80E+33	125.52					
AUG 30 90	97	1	1	1	1	0	16	3.80E+33	125.52					
AUG 31 90	98	1	1	1	1	0	15	1.42E+32	139.17					
SEPT 1 90	99	1	1	1	1	0	14	3.28E+30	151.27					
SEPT 2 90	100	1	1	1	1	0	14	3.28E+30	151.27					
SEPT 3 90	101	1	1	1	1	0	14	3.28E+30	151.27					
SEPT 4 90	102	10	10	10	10	1	14	2.05E+28	105.27	68	0	ZERO	SE	NO
SEPT 5 90	103	1	1	1	1	0	13	6.62E+25	96.68					
SEPT 6 90	104	1	1	1	1	0	12	1.05E+24	100.37					

SEPT 7 90	105	1	1	1	1	0	14	3.49E+22	40.75					
SEPT 8 90	106	1	1	1	1	0	10	4.18E+20	115.38					
SEPT 9 90	107	1	1	1	1	0	10	4.18E+20	115.38	62	4	ZERO	NW	NO
SEPT 10 90	108	1	1	1	1	0	10	4.18E+20	115.38					
SEPT 11 90	109	1	1	1	1	0	9	2.85E+18	112.75					
SEPT 12 90	110	1	1	1	1	0	8	1.71E+15	80.20					
SEPT 13 90	111	1	1	1	1	0	7	1.39E+13	75.41					
SEPT 14 90	112	1	1	1	1	0	6	8.16E+10	65.86					
SEPT 15 90	113	1	1	1	1	0	5	1.06E+09	63.89					
SEPT 16 90M	114	150	90	90	1	0	4	1.52E+07	62.45	62	4	ZERO	NW	YES
SEPT 17 90	115	1	1	1	1	0	4	1.52E+07	62.45					
SEPT 18 90	116	1	1	1	1	0	4	1.52E+07	62.45					
SEPT 19 90	117	1	1	1	1	0	3	3.04E+05	67.25					
SEPT 20 90	118	1	1	1	1	0	3	3.04E+05	67.25					
SEPT 21 90	119	1	1	1	1	0	3	3.04E+05	67.25					
SEPT 22 90	120	1	1	1	1	0	3	3.04E+05	67.25					
SEPT 23 90M	121	270	250	150	1	0	3	3.04E+05	67.25	58	5	ZERO	W	NO
SEPT 24 90	122	1	1	1	1	0	3	3.04E+05	67.25					

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DATE	DAY#	W	C	E	MEAN COUNT	0/1	ROOT	#FACTORIAL	GEO MEAN	H2O TEMP	WAVE HT.	BATHER LD	WIND DIR.	RAIN?
MAY 26 90	1	1	1	1	1	0	0	1 ERR						
MAY 27 90	2	1	1	1	1	0	0	1.00E+00 ERR						
MAY 28 90	3	10	10	10	10	1	1	1.00E+01	10.00	52	0.5	MED	SW	NO
MAY 29 90	4	10	250	90	117	1	2	1.17E+03	34.16	51	2	ZERO	NE	YES
MAY 30 90	5	20	50	70	47	1	3	5.44E+04	37.90	56	0.5	ZERO	E	NO
MAY 31 90	6	10	10	10	10	1	4	5.44E+05	27.16	54	0	ZERO	W	NO
JUNE 01 90	7	1	1	1	1	0	4	5.44E+05	27.16					
JUNE 02 90	8	1	1	1	1	0	4	5.44E+05	27.16					
JUNE 03 90	9	50	220	20	97	1	5	5.26E+07	35.01	50	0.5	LOW	SW	NO
JUNE 04 90	10	80	75	20	58	1	6	3.07E+09	38.12					
JUNE 05 90	11	1	1	1	1	0	6	3.07E+09	38.12					
JUNE 06 90	12	10	10	20	13	1	7	4.09E+10	32.81	59	0	ZERO	W	NO
JUNE 07 90	13	10	10	10	10	1	8	4.09E+11	28.28	60	0.5	LOW	NW	NO
JUNE 08 90	14	1	1	1	1	0	8	4.09E+11	28.28					
JUNE 09 90	15	1	1	1	1	0	8	4.09E+11	28.28					
JUNE 10 90	16	10	30	5	15	1	9	6.14E+12	26.36	58	0.5	LOW	SW	NO
JUNE 11 90	17	10	20	10	13	1	10	8.19E+13	24.62	58	0.5	LOW	NW	NO
JUNE 12 90	18	1	1	1	1	0	10	8.19E+13	24.62					
JUNE 13 90	19	100	100	20	73	1	11	6.00E+15	27.19	64	0.5	MED	W	NO
JUNE 14 90	20	20	200	40	87	1	12	5.20E+17	29.95	58	0	LOW	SW	NO
JUNE 15 90	21	1	1	1	1	0	12	5.20E+17	29.95	60	0.5	LOW	S	NO
JUNE 16 90	22	1	1	1	1	0	12	5.20E+17	29.95	59	0	LOW	SW	NO
JUNE 17 90	23	40	30	30	33	1	13	1.73E+19	30.19	60	0.5	LOW	S	NO
JUNE 18 90	24	350	230	125	235	1	14	4.08E+21	34.96	59	0	LOW	SW	NO
JUNE 19 90	25	1	1	1	1	0	14	4.08E+21	34.96					
JUNE 20 90	26	1	1	1	1	0	14	4.08E+21	34.96					
JUNE 21 90	27	1	1	1	1	0	14	4.08E+21	34.96					
JUNE 22 90	28	1	1	1	1	0	14	4.08E+21	34.96					
JUNE 23 90	29	1	1	1	1	0	14	4.08E+21	34.96					
JUNE 24 90	30	400	210	130	247	1	15	1.01E+24	39.82	66	0	ZERO	NW	YES
JUNE 25 90	31	80	70	40	63	1	16	6.37E+25	41.00	66	0	ZERO	W	NO
JUNE 26 90	32	1	1	1	1	0	16	6.37E+25	41.00					
JUNE 27 90	33	50	130	50	77	1	16	4.88E+26	46.56	66	0	LOW	S	NO
JUNE 28 90	34	200	100	140	147	1	16	6.14E+26	47.23	68	0.5	ZERO	NE	NO
JUNE 29 90	35	1	1	1	1	0	15	1.32E+25	47.27					
JUNE 30 90	36	1	1	1	1	0	14	1.32E+24	52.82					
JULY 1 90	37	130	50	270	150	1	15	1.97E+26	56.62	70	0.5	LOW	NW	NO
JULY 2 90	38	20	10	20	17	1	16	3.29E+27	52.46	72	0	LOW	NW	NO
JULY 3 90M	39	20	20	50	1	0	15	3.40E+25	50.36					
JULY 4 90	40	1	1	1	1	0	14	5.83E+23	49.64					
JULY 5 90	41	180	140	120	147	1	15	9.55E+25	53.56	76	0.5	MED	NE	NO
JULY 6 90	42	1	1	1	1	0	14	6.41E+24	59.15					
JULY 7 90	43	1	1	1	1	0	13	6.41E+23	67.81					
JULY 8 90	44	20	40	30	30	1	14	1.92E+25	63.98	76	0	MED	CALM	NO
JULY 9 90	45	210	200	170	193	1	15	3.72E+27	68.87	72	0	LOW	CALM	NO
JULY 10 90	46	1	1	1	1	0	14	2.48E+26	76.79					
JULY 11 90	47	380	530	150	353	1	14	6.57E+27	97.05	71	0	LOW		NO
JULY 12 90	48	1	1	1	1	0	14	6.57E+27	97.05					
JULY 13 90	49	1	1	1	1	0	13	8.96E+25	99.16					
JULY 14 90	50	1	1	1	1	0	12	1.03E+24	100.28					
JULY 15 90	51	10	20	10	13	1	13	1.38E+25	85.86	68	0	LOW	CALM	NO

JULY 16 90	52	20	20	20	20	1	14	2.76E+26	77.38	68	0	LOW	NE	NO
JULY 17 90	53	1	1	1	1	0	13	8.27E+24	82.55					
JULY 18 90	54	70	150	20	80	1	13	2.82E+24	75.99	71	0	HIGH	NW	NO
JULY 19 90	55	20	30	50	33	1	14	9.39E+25	71.64	70	0	LOW	W	NO
JULY 20 90	56	1	1	1	1	0	14	9.39E+25	71.64					
JULY 21 90	57	1	1	1	1	0	14	9.39E+25	71.64					
JULY 22 90	58	20	60	50	43	1	15	4.07E+27	69.28	74	0.5	LOW	NE	YES
JULY 23 90	59	270	170	150	197	1	16	8.00E+29	73.95	72	1	LOW	SW	NO
JULY 24 90	60	70	30	30	43	1	16	1.41E+29	66.33	76	0	MED	SW	NO
JULY 25 90	61	20	30	20	23	1	16	5.18E+28	62.32	76	0.5	HIGH	N	NO
JULY 26 90	62	180	80	120	127	1	17	6.56E+30	64.98	76	0.5	HIGH	N	NO
JULY 27 90	63	1	1	1	1	0	16	8.55E+28	64.31					
JULY 28 90	64	1	1	1	1	0	15	5.83E+26	60.87					
JULY 29 90	65	160	40	100	100	1	16	5.83E+28	62.79	82	0.5	MED	CALM	NO
JULY 30 90	66	50	20	10	27	1	17	1.56E+30	59.70	80	0	LOW	SW	NO
JULY 31 90	67	1	1	1	1	0	16	1.04E+28	56.36					
AUG 1 90	68	10	10	10	10	1	16	6.22E+27	54.59	71	0.5	LOW	NE	NO
AUG 2 90	69	50	10	10	23	1	17	1.45E+29	51.93	76	0.5	MED	NW	NO
AUG 3 90	70	1	1	1	1	0	17	1.45E+29	51.93					
AUG 4 90	71	1	1	1	1	0	16	9.90E+26	48.67					
AUG 5 90	72	60	190	280	177	1	17	1.75E+29	52.50	72	0	LOW	CALM	NO
AUG 6 90	73	120	1000	800	640	1	18	1.12E+32	60.32	70	0.5	LOW	NE	NO
AUG 7 90	74	1	1	1	1	0	17	3.73E+30	62.85					
AUG 8 90	75	30	50	10	30	1	17	5.79E+29	56.33	72	0	LOW	CALM	NO
AUG 9 90	76	10	80	10	33	1	18	1.93E+31	54.71	74	0.5	HIGH	NE	NO
AUG 10 90	77	1	1	1	1	0	17	5.46E+28	49.03					
AUG 11 90	78	1	1	1	1	0	17	5.46E+28	49.03					
AUG 12 90	79	20	800	20	20	1	19	1.09E+30	46.64	76	0.5	MED	SW	NO
AUG 13 90	80	1000	340	2500	1280	1	19	1.40E+33	55.53	70	0.5	ZERO	NE	YES
AUG 14 90	81	30	20	20	23	1	19	2.45E+33	57.19	73	0.5	LOW	N	NO
AUG 15 90	82	10	10	160	60	1	19	7.34E+33	60.59	74	0.5	LOW	SW	NO
AUG 16 90	83	10	80	10	33	1	20	2.45E+35	58.81	72	0.5	LOW	SW	NO
AUG 17 90	84	80	70	40	63	1	20	1.94E+35	58.12	72	0	ZERO	W	NO
AUG 18 90	85	1	1	1	1	0	19	5.81E+33	59.85					
AUG 19 90M	86	1200	570	1500	1	0	19	5.81E+33	59.85	70	1	ZERO	E	NO
AUG 20 90	87	340	380	290	337	1	20	1.96E+36	65.25	69	0.5	LOW	NE	NO
AUG 21 90	88	10	10	10	10	1	20	4.51E+35	60.64	70	0.5	ZERO	E	NO
AUG 22 90	89	20	20	10	17	1	20	3.83E+34	53.60	68	0.5	ZERO	NE	NO
AUG 23 90	90	30	10	10	17	1	20	1.47E+34	51.10	68	1	LOW	E	NO
AUG 24 90	91	20	10	10	13	1	20	8.41E+33	49.69	72	1	ZERO	SE	NO
AUG 25 90	92	1	1	1	1	0	19	6.64E+31	47.30					
AUG 26 90	93	10	10	20	13	1	20	8.85E+32	44.40	76	0.5	HIGH	SW	NO
AUG 27 90	94	40	80	500	207	1	21	1.83E+35	47.77	72	0.5	LOW	W	NO
AUG 28 90	95	1	1	1	1	0	20	1.93E+33	46.04					
AUG 29 90M	96	20	20	20	1	0	19	6.86E+31	47.38	72	0.5	ZERO	N	NO
AUG 30 90	97	10	20	50	27	1	20	1.83E+33	46.04	70	0.5	MED	SE	NO
AUG 31 90	98	1	1	1	1	0	19	1.83E+32	49.89					
SEPT 1 90	99	1	1	1	1	0	18	7.84E+30	52.04					
SEPT 2 90	100	1	1	1	1	0	18	7.84E+30	52.04					
SEPT 3 90	101	1	1	1	1	0	18	7.84E+30	52.04					
SEPT 4 90	102	10	40	60	37	1	18	1.63E+30	47.69	68	0	ZERO	SE	NO
SEPT 5 90	103	1	1	1	1	0	17	2.54E+27	40.93					
SEPT 6 90	104	1	1	1	1	0	17	2.54E+27	40.93					

SEPT 7 90	105	1	1	1	1	0	16	8.47E+25	41.74					
SEPT 8 90	106	1	1	1	1	0	15	2.54E+24	42.37					
SEPT 9 90	107	1	1	1	1	0	15	2.54E+24	42.37					
SEPT 10 90	108	1	1	1	1	0	15	2.54E+24	42.37					
SEPT 11 90	109	1	1	1	1	0	14	1.27E+23	44.70					
SEPT 12 90	110	1	1	1	1	0	13	9.93E+19	34.53					
SEPT 13 90	111	1	1	1	1	0	12	4.26E+18	35.68					
SEPT 14 90	112	1	1	1	1	0	11	7.09E+16	34.03					
SEPT 15 90	113	1	1	1	1	0	10	2.13E+15	34.10					
SEPT 16 90M	114	60	60	60	1	0	9	3.36E+13	31.84	62	1	ZERO	NW	YES
SEPT 17 90	115	1	1	1	1	0	9	3.36E+13	31.84					
SEPT 18 90	116	1	1	1	1	0	9	3.36E+13	31.84					
SEPT 19 20	117	1	1	1	1	0	8	9.98E+10	23.71					
SEPT 20 90	118	1	1	1	1	0	7	9.96E+09	26.82					
SEPT 21 90	119	1	1	1	1	0	6	5.99E+08	29.03					
SEPT 22 90	120	1	1	1	1	0	5	3.59E+07	32.44					
SEPT 23 90M	121	20	80	40	1	0	4	2.69E+06	40.51	58	1	ZERO	W	NO
SEPT 24 90	122	1	1	1	1	0	4	2.69E+06	40.51					

APPENDIX C

1990 Chem Sample Results

LABORATORY REPORT
FOR SAMPLE NUMBER 9000355

RECEIVED 5/03/90
REPORTED 7/27/90

COLLECTOR	S.ZURAD CEC/ECHD	SAMPLING DATE	5/03/90
COLLECTOR NO.	1690004	SAMPLING TIME	2:10
ESTABLISHMENT	PRESQUE ISLE ST. PARK	WQN	000
CASE NAME	LAKE REPLENISHMENT SAND	TYPE	00
FACILITY	ERIE SAND & GRAVEL	SOURCE	00
ID CODE		STANDARD ANAL	000

LATITUDE 00:00:00.0 LONGITUDE 00:00:00.0

LABORATORY ANALYSIS:

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE	COMMENT
40610	NH3 ASTMA		0.0500	MG/L	G	WCZ	7/02/90	
40615	NO2 ASTMA		0.0040	MG/L	G	WCZ	7/02/90	
40620	NO3 ASTMA		0.1100	MG/L	G	WCZ	7/02/90	
40665	P TOT ASTMA	<	0.0200	MG/L	G	WCZ	7/02/90	
40940	CL ASTM-A	<	1.0000	MG/L	G	WCZ	7/02/90	
90002	ASTMA HEOLCH		0.0000		G	WCZ	6/13/90	***SEE QUAL REPORT-COMMENTS
99007	QUALITATIVE		0.0000		G	WCZ	7/02/90	***SEE QUAL REPORT-COMMENTS

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 7

ANALYST COMMENTS

TEST	COMMENTS	ANALYST
90002E	== ASTM METHOD D3987-85 DISTILLED WATER LEACH PROCEDURE 20:1 REAGENT GRADE WATER/SAMPLE RATIO (WET BASIS) 18 HOUR ROTARY EXTRACTION TIME ==	WCZ
99007S	== MISC. RESULTS FROM ASTM-A LEACH: TOC = 1.5 MG/L SO4 = < 10.0 MG/L ==	WCZ

JE Manczka
8/7/90

LABORATORY REPORT
FOR SAMPLE NUMBER 9000305

RECEIVED 4/26/90
REPORTED 7/27/90

COLLECTOR	S.ZURAD CEC/ECHD	SAMPLING DATE	4/26/90
COLLECTOR NO.	1690002	SAMPLING TIME	11:30
ESTABLISHMENT	ERODED BLUFF MATERIAL	WQN	000
CASE NAME		TYPE	00
FACILITY	SHOREHAVEN AREA	SOURCE	00
ID CODE		STANDARD ANAL	100

LATITUDE 00:00:00.0 LONGITUDE 00:00:00.0

LABORATORY ANALYSIS:

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE	COMMENT
40403	PH H2O LEACH		7.6200		G	WCZ	7/02/90	
40610	NH3 ASTMA		0.1000	MG/L	G	WCZ	7/02/90	
40615	NO2 ASTMA	<	0.0040	MG/L	G	WCZ	7/02/90	
40620	NO3 ASTMA		0.0900	MG/L	G	WCZ	7/02/90	
40665	P TOT ASTMA	<	0.0200	MG/L	G	WCZ	7/02/90	
90002	ASTMA H2OLCH		0.0000		G	WCZ	6/13/90	***SEE QUAL REPORT-COMMENTS
99007	QUALITATIVE		0.0000		G	WCZ	7/02/90	***SEE QUAL REPORT-COMMENTS

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 7

ANALYST COMMENTS

TEST	COMMENTS	ANALYST
90002E	ASTM METHOD D3987-85 DISTILLED WATER LEACH PROCEDURE 20:1 REAGENT GRADE WATER/SAMPLE RATIO (WET BASIS) 18 HOUR ROTARY EXTRACTION TIME	WCZ
99007S	MISC. RESULTS FROM ASTM-A LEACH: TOC = 2.5 MG/L	WCZ

JE Manczka
8/7/90

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

LABORATORY REPORT
FOR SAMPLE NUMBER H9027833

RECEIVED 5/04/90
REPORTED 5/21/90

COLLECTOR	S.ZURAD CEC/ECHD	SAMPLING DATE	5/02/90
COLLECTOR NO.	1690003	SAMPLING TIME	
ESTABLISHMENT	CITY OF ERIE	STANDARD ANAL	100
CASE NAME	LIFT STATION OVERFLOW	TYPE CODE	
FACILITY	CHAUTAQUA AVE.	WQN	
ID CODE	Sewer overflow	STREAM CODE	
		RIVER MILE IND	

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00310	BOD 5-DAY		105.0000	MG/L	G	WET	5/10/90
00610A	T NH3-N		7.4800	MG/L	G	BLF	5/08/90
00665A	PHOS-T MG/L		3.4100	MG/L	G	BBM	5/09/90
38260	MBAS AS MG/L	<	0.5000	MG/L	G	FFV	5/04/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 4

ERIE CO. DEPT. OF HEALTH
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LABORATORY REPORT
FOR SAMPLE NUMBER H9029506

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. 0690009
ESTABLISHMENT BEACHCOMBER CAMP STREAM
CASE NAME Low flow
FACILITY
ID CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 11:30
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	1.8700	MG/L	6	BLF	5/18/90
00615A	T NO2-N	0.0700	MG/L	6	BLF	5/18/90
00620A	T NO3-N	1.1400	MG/L	6	BLF	5/18/90
00665A	PHOS-T MG/L	0.1900	MG/L	6	EBM	5/24/90
00680	T ORG C MG/L	8.2000	MG/L	6	WVM	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

ERIE CO. DEPT. OF HEALTH
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LABORATORY REPORT
FOR SAMPLE NUMBER HS029507

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. 0690010
ESTABLISHMENT BEACHCOMBER CAMPGROUND
CASE NAME KELSO BEACH STORMWATER
FACILITY Low flow
TD CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 2:45
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.5200	MG/L	G	BLF	5/18/90
00615A	T NO2-N	0.0480	MG/L	G	BLF	5/18/90
00620A	T NO3-N	1.5800	MG/L	G	BLF	5/18/90
00665J	PHOS-T MG/L	0.0700	MG/L	G	BEM	5/24/90
00680	T ORG C MG/L	6.2000	MG/L	G	WVM	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

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LABORATORY REPORT
FOR SAMPLE NUMBER H9C29505

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. 0690008
ESTABLISHMENT MARSHALL RUN
CASE NAME Low flow
FACILITY
ID CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 12:20
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.0500	MG/L	G	BLF	5/18/90
00615A	T NO2-N	0.0100	MG/L	G	BLF	5/18/90
00620A	T NO3-N	0.8500	MG/L	G	BLF	5/18/90
00665A	PHOS-T MG/L	0.0500	MG/L	G	EBM	5/24/90
00680	T ORG C MG/L	5.3000	MG/L	G	WVM	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

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LABORATORY REPORT
FOR SAMPLE NUMBER HYC29504

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. C690007
ESTABLISHMENT SHORHAVEN CREEK.
CASE NAME Low flow
FACILITY
ID CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 12:55
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	<	0.0200	MG/L	G	BLF	5/18/90
00615A	T NO2-N		0.0060	MG/L	G	BLF	5/18/90
00620A	T NO3-N		1.6600	MG/L	G	BLF	5/18/90
00665A	PHOS-T MG/L		0.0600	MG/L	G	EBM	5/24/90
00680	T ORG C MG/L		3.2000	MG/L	G	WVR	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

ERIE CO. DEPT. OF HEALTH
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LABORATORY REPORT
FOR SAMPLE NUMBER HSC29503

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. C690006
ESTABLISHMENT WILKINS RUN
CASE NAME Low flow
FACILITY
ID CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 1:20
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.0600	MG/L	G	BLF	5/18/90
00615A	T NO2-N	0.0100	MG/L	G	BLF	5/18/90
00620A	T NO3-N	0.4300	MG/L	G	BLF	5/18/90
00665A	PHOS-T MG/L	0.0900	MG/L	G	BEM	5/24/90
00680	T ORG C MG/L	6.4000	MG/L	G	KVM	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

ERIE CO. DEPT. OF HEALTH
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LABORATORY REPORT
FOR SAMPLE NUMBER H9029502

RECEIVED 5/15/90
REPORTED 5/24/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. C690005
ESTABLISHMENT WLNUT CREEK
CASE NAME Low flow
FACILITY
ID CODE

SAMPLING DATE 5/14/90
SAMPLING TIME 1:45
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	<	0.0200	MG/L	G	ELF	5/18/90
00615A	T NO2-N		0.0060	MG/L	G	ELF	5/18/90
00620A	T NO3-N		0.6800	MG/L	G	ELF	5/18/90
00665A	PHOS-T MG/L		0.0400	MG/L	G	HVM	5/24/90
00680	T ORG C MG/L		4.6000	MG/L	G	HVM	5/15/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

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LABORATORY REPORT RECEIVED 9/06/90
FOR SAMPLE NUMBER RY05250 REPORTED 9/12/90

COLLECTOR	J.TRZYBINSKI ICHD	SAMPLING DATE	9/05/90
COLLECTOR NO.	0690013	SAMPLING TIME	11:10
ESTABLISHMENT	MARSHALLRUN	STANDARD ANAL	000
SITE NAME	High flow	TYPE CODE	
FACILITY		WQN	
ZIP CODE		STREAM CODE	
		RIVER MILE IND	

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N		0.5300	MG/L	6	EVC	9/07/90
00615A	T NO2-N		0.0920	MG/L	6	EVC	9/07/90
00620A	T NO3-N		2.0000	MG/L	6	EVC	9/07/90
00665A	PHOS-T MG/L		0.3500	MG/L	6	BBM	9/12/90
00680	T ORG C MG/L		11.4000	MG/L	6	KVM	9/06/90
78260	MEAS AS MG/L	<	0.5000	MG/L	6	FFV	9/06/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 6

SEP 20 1990

120

[illegible]
[illegible]

PAGE 1

LABORATORY REPORT
FOR SAMPLE NUMBER #5052505

RECEIVED 9/06/90
REPORTED 9/12/90

COLLECTOR J.TRZYBINSKI LTFO
COLLECTOR NO. 0690110
ESTABLISHMENT SHOREHAVEN CREEK
LAST NAME BELOW LIFT STATION
FACILITY High flow
ID CODE

SAMPLING DATE 9/05/90
SAMPLING TIME 10:05
STANDARD ANAL 000
TYPE CODE
WRS
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00610	T NH3-N		0.3000	MG/L	G	[illegible]	9/07/90
00615	T NO2-N		0.0200	MG/L	G	[illegible]	9/07/90
00620	T NO3-N		1.9700	MG/L	G	[illegible]	9/07/90
00665A	PHOS-T MG/L		0.3700	MG/L	G	[illegible]	9/12/90
00680	T ORG C MG/L		7.2000	MG/L	G	[illegible]	9/06/90
38260	MBAS AS MG/L	<	0.5000	MG/L	G	[illegible]	9/06/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 6

SEP 20 1990

121

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

LABORATORY REPORT
FOR SAMPLE NUMBER [illegible]052507

RECEIVED 9/06/[illegible]
REPORTED 9/12/[illegible]

COLLECTOR J.TRZYBINSKI FCPD
COLLECTOR NO. C690012
ESTABLISHMENT FOOT OF POWELL AVE
CASE NAME STORM DRAINAGE .
FACILITY High flow
FC CODE

SAMPLING DATE 9/05/90
SAMPLING TIME 10:50
STANDARD ANAL 000
TYPE CODE
WRR
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION		RESULT	COND	VERIFY	BY	VERIFY DATE
00610A	T NH3-N		0.6100	MG/L	G	EVC	9/07/90
00615A	T NO2-N		0.0520	MG/L	G	EVC	9/07/90
00620A	T NO3-N		2.1500	MG/L	G	EVC	,/07/90
00665A	PHOS-T MG/L		0.3500	MG/L	G	BJM	9/12/90
00680	T ORG C MG/L		9.3000	MG/L	G	WZM	9/06/93
70260	REAS OS MG/L	<	0.5000	MG/L	G	FFW	9/06/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 6

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

LABORATORY REPORT
FOR SAMPLE NUMBER FV052506

RECEIVED 9/06/90
REPORTED 9/12/90

COLLECTOR J.TRZYBINSKI ECRO
COLLECTOR NO. C690011
ESTABLISHMENT FOOT OF MONTPELIER
BASE NAME STORM DRAINAGE
FACILITY High flow
ID CODE

SAMPLING DATE 9/05/90
SAMPLING TIME 10:25
STANDARD ANAL 000
TYPE CODE
WRW
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.0900	MG/L	6	FVC	9/07/90
00615A	T NO2-N	0.0100	MG/L	6	FVC	9/07/90
00620A	T NO3-N	2.1900	MG/L	6	FVC	9/07/90
00665A	PHOS-T MG/L	0.0300	MG/L	6	BBM	9/12/90
00680	T ORG C MG/L	2.5000	MG/L	6	WVM	9/06/90
38260	MBAS AS MG/L <	0.5000	MG/L	6	FFV	9/06/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 6

SEP 20 1990

12

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

LABORATORY REPORT
FOR SAMPLE NUMBER [illegible]0525[illegible]

RECEIVED 9/05/90
REPORTED 9/12/90

COLLECTOR J.TRZYBINSKI ECHO
COLLECTOR NO. C690014
ESTABLISHMENT WALNUT CREEK
SITE NAME High flow
FACILITY
CO CODE

SAMPLING DATE 9/05/90
SAMPLING TIME 14:00
STANDARD ANAL 000
TYPE CODE
WQN
STREAM CODE
RIVER MILE IND

TEST	DESCRIPTION	RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.2300	MG/L	6	EVC	9/07/90
00615A	T NO2-N	0.05[illegible]0	MG/L	6	EVC	9/07/90
00620A	T NO3-N	1.1300	MG/L	6	EVC	9/07/90
00665A	PHOS-T MG/L	0.3900	MG/L	6	BAA	9/12/90
00680	T ORG C MG/L	8.9000	MG/L	6	WVP	9/06/90
38260	MBAS AS MG/L <	0.5000	MG/L	6	FFV	9/06/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 6

20 1990

COMMONWEALTH OF PENNSYLVANIA PAGE 1
DEPARTMENT OF ENVIRONMENTAL RESOURCES

LABORATORY REPORT RECEIVED 10/03/90
FOR SAMPLE NUMBER 1505-928 REPORTED 10/11/90

COLLECTOR	J.TRZYBINSKI ECHD		SAMPLING DATE	10/01/90
COLLECTOR NO.	C690021		SAMPLING TIME	14:15
ESTABLISHMENT	KELSO BEACH		STANDARD ANAL	000
CASE NAME			TYPE CODE	
FACILITY	MILLCREEK STORM DRAIN		NPS	
ID CODE			STREAM CODE	
			RIVER MILE IND	

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE
00610A	T NH3-N		0.1200	MG/L	6	BLF	10/10/90
00615A	T NO2-N		[illegible]	MG/L	6	BLF	10/10/90
00620A	T NO3-N		1.5400	MG/L	6	BLF	10/10/90
00665A	PHOS-T MG/L		0.0500	MG/L	6	B[illegible]	10/11/90
79260	[illegible] AS MG/L	<	0.5000	MG/L	6	FFV	10/03/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

ERIE CO. DEPT. OF HEALTH
OCT 24
ENVIRONMENTAL HEALTH
SERVICES

TH

ALTH

[illegible]
[illegible]

[illegible] — DATE [illegible]
[illegible] — PRINTED 10/11/90

COLLECTOR	J.TEZYBINSKI SCHD	SAMPLING DATE	10/01/90
COLLECTOR NO.	1690022	SAMPLING TIME	14:30
ESTABLISHMENT	CRYSTAL POINT CONDOS	[illegible]	[illegible]
[illegible]		TYPE CODE	
FACILITY	STORM WATER	[illegible]	
ID CODE		[illegible]	
		RIVER MILE [illegible]	

TEST	DESCRIPTION	RESULT	CODE	VERIFY	BY	VERIFY DATE
00610A	T NH3-N	0.1000	MG/L	6	BLF	10/10/90
00615A	T NO2-N	0.0200	MG/L	[illegible]	BLF	10/10/90
00620A	T NO3-N	0.7100	MG/L	[illegible]	BLF	10/10/90
00665A	PHOS-T MG/L	1.[illegible]	MG/L	[illegible]	BB	10/11/90
31260	[illegible] MG/L <	0.5000	MG/L	[illegible]	FFV	10/03/90

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

[illegible] CO. DEPT. OF HEALTH
OCT 24 1990
ENVIRONMENTAL HEALTH
SERVICES

COLLECTOR J. [illegible]ZYNSKI [illegible]
COLLECTOR NO. [illegible]69[illegible]20
ESTABLISHMENT [illegible]. 26TH & [illegible]
[illegible]
FACILITY [illegible] WATER [illegible]TENTION
[illegible] CODE

SAMPLING [illegible] 10/02/[illegible]
SAMPLING TIME 10:25
[illegible]
[illegible] CODE
[illegible]
[illegible]

TEST	DESCRIPTION		RESULT	UNIT	[illegible]	[illegible]	[illegible]
[illegible]4104	[illegible]HB3-[illegible]		0.[illegible]00	[illegible]/L	6	[illegible]	10/10/90
[illegible]4150	[illegible]2-[illegible]		0.[illegible]12[illegible]	[illegible]/L	[illegible]	[illegible]	10/10/[illegible]
[illegible]620	[illegible]3-[illegible]	<	0.[illegible]	[illegible]/L	[illegible]	[illegible]	10/10/[illegible]
[illegible]65[illegible]	PHOS-[illegible]/L		1.3[illegible]	[illegible]/L	[illegible]	[illegible]	10/11/90
3[illegible]260	[illegible]S [illegible]/L	<	0.5000	[illegible]/L	[illegible]	[illegible]	10/03/[illegible]

TOTAL [illegible] OF TESTS FOR [illegible] 5

[illegible]

[illegible] 27

COLLECTOR	J. [illegible]ZYBISKI [illegible]	SAMPLING DATE	10/02/9[illegible]
COLLECTOR NO.	0690020	SAMPLING TIME	10:25
ESTABLISHMENT	[illegible] 26TH & COLONIAL	[illegible]	[illegible]
[illegible] NAME		TYPE CODE	
FACILITY	STORM WATER RETENTION	[illegible]	
ZIP CODE		STREAM CODE	
		[illegible]	

TEST	DESCRIPTION		RESULT	UNIT	VERIFY	BY	VERIFY DATE
[illegible]410[illegible]	T NH3-N		0.[illegible]00	MG/L	[illegible]	[illegible]	10/10/90
[illegible]415[illegible]	T NO2-N		0.[illegible]12[illegible]	MG/L	[illegible]	[illegible]	10/10/90
[illegible]620[illegible]	T NO3-N	<	0.0400	MG/L	[illegible]	[illegible]	10/10/90
[illegible]665[illegible]	PHOS-T MG/L		1.3400	MG/L	[illegible]	[illegible]	10/11/90
3[illegible]260	[illegible] AS MG/L	<	0.5000	MG/L	[illegible]	[illegible]	10/03/9[illegible]

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 5

12[illegible]

LABORATORY REPORT
FOR SAMPLE NUMBER 9000739

RECEIVED 9/20/90
REPORTED 12/26/90

COLLECTOR J.TRZYBINSKI ECHD
COLLECTOR NO. 0690016
ESTABLISHMENT KELSO BEACH ASSN.
CASE NAME SEDIMENT
FACILITY MILLCREEK STORM SEWER
ID CODE

SAMPLING DATE 9/20/90
SAMPLING TIME 11:35
WQN 000
TYPE 00
SOURCE 00
STANDARD ANAL 000

LATITUDE 00:00:00.0 LONGITUDE 00:00:00.0

LABORATORY ANALYSIS:

TEST	DESCRIPTION		RESULT	CONC	VERIFY	BY	VERIFY DATE	COMMENT
40008	PH CORROSVTY		7.3900	PH	G	GLM	10/12/90	
40403	PH H20 LEACH		7.3700		G	GLM	12/26/90	
40615	NO2 ASTMA		0.0120	MG/L	G	GLM	12/26/90	
40620	NO3 ASTMA		0.2700	MG/L	G	GLM	12/26/90	
40665	P TOT ASTMA	<	0.0200	MG/L	G	GLM	12/26/90	
90002	ASTMA H2OLCH		0.0000		G	WCZ	11/28/90	***SEE QUAL REPORT-COMMENTS
99007	QUALITATIVE		0.0000		G	GLM	12/26/90	***SEE QUAL REPORT-COMMENTS

TOTAL NUMBER OF TESTS FOR THIS SAMPLE 7

ANALYST COMMENTS

TEST	COMMENTS	ANALYST
90002E	ASTM METHOD D3987-85 DISTILLED WATER LEACH PROCEDURE 20:1 REAGENT GRADE WATER/SAMPLE RATIO (WET BASIS) 18 HOUR ROTARY EXTRACTION TIME	WCZ
99007S	MISC RESULTS FROM ASTM DI WATER LEACH: TOC = 2.7 MG/L MBAS < 0.5 MG/L	GLM

JE Manafa
1/2/91

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APPENDIX D

Miscellaneous Stream and Storm Water Samples

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
2/6/90	Dunn Boulevard Creek	Muddy	58,000
2/6/90	Chautauqua Boulevard lift station overflow pipe	Sewage debris from recent overflow present	3,150
2/7/90	Chautauqua Boulevard lift station overflow pipe	Sewage debris from recent overflow present	5,100
4/25/90	Chautauqua Boulevard hillside discharge	Sewage debris on beach	>60,000
5/2/90	Halley Street storm sewer		50
5/3/90	Water running across Peninsula Drive (west to east) in the area of Waldameer		49,000
5/7/90	Shorehaven Creek:		
	Near mouth		190
	Just downstream of lift station		260
	Just upstream of lift station		400
	About 200 ft. upstream of lift station (but downstream from duck ponds)		320
5/14/90	Storm pipe to shoreline - west of Marshall Run		<10

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
5/14/90	Small stream to shoreline midway between Marshall Run and Shorehaven Creek		420
6/5/90	Scott's Run - west branch (next to lift station)		10 fecal coli <10 *E. coli*
6/5/90	Scott's Run - south branch		21,000
6/5/90	Scott's Run - downstream of where the two branches meet		16,000
6/5/90	Scott's Run - behind boat store		8,000 fecal coli 6,200 *E. coli*
6/5/90	Scott's Run - near mouth		10,000 fecal coli 4,600 *E. coli*
6/8/90	Baer Beach - storm water pipe on west	Rain in a.m.	570
6/8/90	Baer Beach - storm water pipe on east		1,000
6/8/90	Scott's Run - west branch	Rain in a.m.	70
6/8/90	Scott's Run - south branch		18,000
6/8/90	Scott's Run - behind bait shop		9,000
6/8/90	Storm water retention area - near West 26th and Colonial		1,000

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
6/20/90	Walnut Creek access area north basin	Suspected sewage lift station malfunction upstream 2-3 days previously, some solids were still floating in the basin	3,000
6/25/90	Inlet to collapsed storm drain exiting into Beach 1 West (inlet is by Sara's Restaurant)	Wet weather	3,000
7/2/90	Scott's Run - west branch	Dry weather	310
7/2/90	Scott's Run - south branch		5,000
7/9/90	Scott's Run - west branch	Wet weather	2,300 fecal coli 300 *E. coli*
7/9/90	Scott's Run - south branch		44,000 fecal coli 40,000 *E. coli*
7/9/90	Inlet to collapsed storm drain exiting onto Beach 1 West		32,000
7/10/90	"Shoreline hole" dug in sediment accumulated in collapsed storm drain outlet on Beach 1 West:		
	Sand		<10/10 g
	Water		300

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
7/10/90	"Shoreline hole" - Beach 1 West		
	Sand		40/10 g
	Water		1,000
7/17/90	Scott's Run - west branch	Dry weather	120
7/17/90	Scott's Run - south branch:		
	Next to lift station		530
	Upstream in woods, area of drive-in theater		>6,000
	Upstream, just north of West 6th Street near peninsula		>6,000
	Tributary of south branch of Scott's Run at West 10th, near peninsula		180
7/20/90	Scott's Run - west branch		200
7/20/90	Scott's Run - south branch		400
7/20/90	Inlet to collapsed storm drain exiting onto Beach 1 West		>600
7/20/90	Presque Isle Shores Condominium Beach:		
	East		410
	West		1,200

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
7/26/90	Kelso Access Road - water running in ditch		290
7/31/90	Kelso Beach - puddle in parking lot	Wet weather	>60,000
7/31/90	Marshall Run:		
	Near mouth		5,200
	South of West Lake Road, west of cemetery		5,700
	Near 15th and Harper Drive (behind booms)		12,000
	End of tube at 22nd and Midland		1,700
	Behind Erie Ceramic (south of railroad tracks)		1,800
8/3/90	Dunn Boulevard Creek	Dry weather, much algae on beach	1,080
8/3/90	Dunn Boulevard Beach:		
	Near shore in algae (1 ft. water)		1,000
	Outside of algae zone (2 ft. water)		300
8/3/90	Creek from Erie Coke		40

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
8/6/90	Dunn Boulevard Creek		6,000
8/6/90	Shade's Beach (near shore)		80
	Foamy material at shoreline		2,600
8/8/90	Beachcomber Campground - ditch by arcade		>60,000
8/9/90	Kelso Beach - storm drain behind parking lot		1,300
	Sediment from above catch basin		1,100/10 g
8/9/90	Storm drain at foot of Montpelier Avenue		<20
8/12 - 8/13/90	See Table 2		
8/13/90	Calvary Cemetery - puddle	Wet weather	7,000
8/13/90	Puddle near mouth of Marshall Run		>60,000
8/22/90	Small stream from Waldameer - near Beachcomber office		1,000
8/26/90	See Table 3		
9/5 - 9/6/90	See Table 4		

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/12/90	Kelso Beach - storm water overflowing from storm drain behind parking lot		2,000
9/12/90	Kelso Beach - storm water (above) mixed with sediment		18,000
9/12/90	Kelso Beach parking lot - puddle		2,000
9/12/90	Baer Beach - ditch draining into Marshall Run		40
9/12/90	Marshall Run - west branch (area of 700 block of Marshall Drive)		1,000
9/12/90	Marshall Run - south branch (area of 700 block of Marshall Drive)		160
9/12/90	Ditch - south side of West 17th, 1/2 block west of Marshall Drive		40
9/12/90	Ditch - northwest corner of West 17th and Marshall		>60,000
9/12/90	Ditch next to ball field near West 17th and Linden		90
9/12/90	Ditch in front of 1610 Linden		<10
9/12/90	Ditch in trailer park (West 15th and Clifton)		1,000
9/12/90	Marshall Run at West 15th and Harper		180

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/12/90	Marshall Run at 10th and Michigan		230
9/14/90	Waldameer - puddle at top of bluff, on west side of property		60
9/14/90	Storm water in gully near Kelso access road (goes to storm drain at the back of the Kelso property, then exits to Lake Erie via the Beachcomber Camp creek)		2,000
9/14/90	Pond at Shoreline Apartments		150
9/17/90	Puddle (muddy) in trailer park on West 6th Street, across from New Process	Wet weather	2,000
9/17/90	Puddle - corner of West 6th Street and West Lake Road		1,000
9/17/90	Puddle - Calvary Cemetery, near center (on paved road)		460
9/17/90	Puddle (muddy) - east end of Calvary Cemetery, near West 10th Street gate		>60,000
9/17/90	Puddle - West 11th Street, just south of Calvary Cemetery (sparrows were bathing in the puddle)		1,000
9/17/90	Marshall Run - south branch at 700 block of Marshall Drive		1,000

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/17/90	Marshall Run - west branch at 700 block of Marshall Drive		1,000
9/17/90	Marshall Run - just south of West Lake Road		1,000
9/17/90	Shorehaven Creek:		
	Near mouth (a man was shoveling sediment and moving debris in the streambed just upstream of the sampling point)		4,000
	Just downstream of lift station		1,000
	Upstream of lift station, just downstream of last duck pond		1,000
	Water running into first duck pond		10
9/17/90	Mouth of small stream which drains the Clifton Drive area		460
9/17/90	Marshall Run:		
	Near mouth		3,000
	At West 10th and Michigan		930
	At West 15th and Harper		2,000
	Near West 14th and Clifton Drive		1,000
	Just north of West 22nd and Midland Drive		460

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/17/90	Storm water retention area at West 26th near Colonial		2,000
9/17/90	Flooded area - southwest corner of West 12th and Harper Drive		8,000
9/18/90	Presque Isle:		
	Puddle - second bay parking lot		1,000
	Puddle - Nature Center parking lot		80
	Puddle - on lake-side road, by Beach 1		60
	Ditch on west side of Peninsula Drive, next to beige water slides at Waldameer		130
	Water running down hill to ditch from area of water slides (above)		1,200
	First catch basin north of Waldameer's driveway on Peninsula Drive		2,000
9/18/90	Puddle - 3000 block of West 9th Street (behind Trinity Cemetery)		6,000
9/18/90	Storm water - foot of Powell Avenue		1,800

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/18/90	Storm water (above) at 400 block of Powell Avenue		190
9/18/90	Trinity Cemetery - puddle at northwest side of cemetery		30
9/18/90	Puddle at corner of West 6th Street and West Lake Road		760
9/18/90	Sediment from storm water retention area on West 26th near Colonial		>60,000/10 g
9/18/90	Ditch - Hastings Avenue north of West 32nd Street		110
9/18/90	Sediment from the above ditch		100/10 g
9/18/90	"Creek" at 3400 block of Pondview		340
9/18/90	Sediment from the above "creek"		700/10 g
9/19/90	Storm water running into catch 2600 block of East 33rd Street	Wet weather	680
9/19/90	Four Mile Creek at Station and Shannon Roads		240
9/19/90	Ditch near St. Benedictine Sisters on East Lake Road (muddy)		220
9/19/90	"Pothole" in road near ditch above		16,000
9/19/90	Behrend College - creek by barn, at foot bridge		3,000

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/19/90	Behrend College - puddle by visitors' parking area		27,000
9/19/90	Puddle on street, 800 block of West 21st Street		6,000
9/19/90	Puddle - Rolling Ridge School parking lot		50
9/19/90	Puddle in the middle of Cherry Street next to the Health Department building		1,000
9/19/90	Gannon University - puddle in front of Zurn Science Building		>60,000
9/19/90	Puddle - Erie Day School parking lot		9,000
9/19/90	Puddle by entrance to One Zurn Place		2,000
9/19/90	Puddle - 1400 block of South Shore Drive		<1,000
9/19/90	Puddle - Villa Maria College campus		9,000
9/19/90	Puddle - top of State Street (Glenwood Hills)		1,300
9/19/90	Puddle - East Grandview behind Mercyhurst Prep		22,000
9/19/90	Puddle - parking lot behind Zurn Science Building, Mercyhurst College		33,000
9/19/90	Puddle - Wintergreen Gorge Cemetery		700

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/20/90	Gully near the Kelso access road:		
	Storm water		400 fecal coli 330 *E. coli* 12,000 fecal strep
	Sediment		27,000 fecal coli/10 g 17,000 fecal strep/10 g
9/20/90	Storm sewer at the bottom of the Kelso access road:		
	Storm water		1,000 fecal coli 1,080 *E. coli* 5,000 fecal strep
	Sediment		2,900 fecal coli/10 g 7,000 fecal strep/10 g
9/20/90	Wet sediment where drainage is seeping downhill from Kelso Vacationland to Kelso Beach access road		1,600
9/20/90	Rain water in a tire (Kelso Beach)		10
9/20/90	Puddle on West 15th between Peninsula and Harper Drives		420
9/20/90	Flooded yard - northeast corner of West 15th and Harper Drive		500

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/20/90	Ditch - Harper Drive south of West 15th Street		30
9/20/90	Wet sediment - bottom of above ditch (was run as a liquid)		3,000
9/20/90	Puddle - 3400 block of West 12th		7,000
9/20/90	Puddle - south of West 12th Street near airport lift station		220
9/20/90	Puddle - on Wolf Road near West Lake Road - very muddy from land-moving operations at Wolf Run		700
9/20/90	Lake Shore Golf Course		
	Stream		7,000
	Stream nearer to mouth in woods		200
	Small stream near a sewage lift station		300
9/20/90	Ditch on Manchester Road, north of West Lake Road		40
9/20/90	Creek/storm drain at Foxglove Lane		900

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/24/90	Foot of Chautauqua Boulevard:	Wet weather earlier	
	Overflow pipe into stream		>60,000 fecal coli >60,000 *E. coli* >60,000 fecal strep
	Stream upstream of overflow discharge		>60,000 fecal coli >60,000 *E. coli* >60,000 fecal strep
	Stream downstream of overflow discharge		>60,000 fecal coli >60,000 *E. coli* >60,000 fecal strep
9/24/90	Foot of Dunn Boulevard - creek/combined sewer overflow		42,000 fecal coli 35,000 *E. coli* 25,000 fecal strep
9/24/90	Puddle near the Dunn Boulevard		8,000 fecal coli 4,000 *E. coli* 23,000 fecal strep
9/24/90	Kelso Beach - puddle (overflow from storm drain)		1,200
9/24/90	Kelso Beach - damp sand between storm drain and parking lot		400/10 g
9/24/90	Kelso Beach - puddle in parking lot		2,000
9/24/90	Kelso Beach - sediment from parking lot puddle		27,000/10 g

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/24/90	Puddle in private drive between Crystal Point and Kelso property (Crystal Point storm drainage route)		38,000
9/24/90	Damp soil west of drive (above)		11,000/10 g
9/24/90	Crystal Point storm water from end of pipe		1,000
9/24/90	Crystal Point - wet sediment at end of storm water pipe		27,000/10 g
9/24/90	Pond at Shoreline Apartments		80
9/24/90	Sediment from pond above		350/10 g
9/25/90	Presque Isle:		
	Lily Pond (by Administration Building		20
	Marina Lake (at Public Boat Ramp)		30
	West end of Long Pond (at bridge)		70
	Marshy area at edge of Big Pond (near Perry Monument)		10
	Graveyard Pond		50
	Niagara Pond		<10
	Horseshoe Pond		<10

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/25/90	Presque Isle:		
	Marshy area next to Sidewalk Trail		1,200
	Puddle at base of Beach 11 sand mound		10
	Beach 10 - large puddle in west parking lot		180
	Marshy area next to Marsh Trail		40
9/26/90	Presque Isle:		
	Puddle between east sand mound and aerobic tanks at Beach 1		11,000
	Puddle at base of west sand mound at Beach 1		200
9/26/90	Puddle - Sara's Restaurant driveway		2,500
9/26/90	Beachcomber Camp:		
	Ditch by arcade		9,000
	Ditch on west side of playground		13,000
	Ditch on east side of playground		4,300
	Hole in ground south of playground (end of storm pipe could be seen in hole)		500
	Puddle in camp road		5,500

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
9/27/90	Kelso Beach (storm drain has been excavated and is now a trench):		
	Usual sampling site, at catch basin behind parking lot		510
	Downstream, at end of trench (at fence between Kelso and Beachcomber Campground)		1,300
9/27/90	Beachcomber Campground - drainage from Waldameer, east side of camp		<10
9/28/90	Lakeshore Golf Course:		
	Stream		10
	Downstream, in woods		40
10/1/90	Crystal Point storm water		19,000
10/1/90	Small stream east of Shorehaven, at mouth		280
10/2/90	Walnut Creek at Kearsarge lift station		440
10/2/90	Ditch - West 40th Street, just east of Sterrettania		480
10/2/90	Storm water retention area at Porreco Extension Center (on West 38th Street)		40
10/2/90	Water with suspended sediment from retention area above		180

Miscellaneous Stream and Storm Water Samples

Date	Location	Special Conditions	Fecal Coliform/ 100 ml
10/2/90	Storm water culvert in front of Porreco Extension Center		360
10/2/90	Puddle in front of Millcreek Township Building on West 26th Street		3,000
10/22/90	Combined sewer overflow at foot of Dunn Boulevard	Wet weather	34,000
10/22/90	Foot of Chautauqua Boulevard - overflow pipe to stream		>60,000
10/22/90	Foot of Halley Street - storm water		130